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CUTTER REEK 1957

Conservation Report

DEPARTMENT OF PLANNING AND DEVELOPMENT

GOVT PUBNS

IAN BURTON

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Oak forests are typical on the sandy soils. Originally they contained much more pine than at present.

DEPARTMENT OF PLANNING AND DEVELOPMENT

HON. W. M. NICKLE, Q.C.
Minister

T. A. C. TYRRELL
Deputy Minister

A. H. RICHARDSON
Chief Conservation Engineer

OTTER
VALLEY
CONSERVATION
REPORT
1957



TORONTO

1957

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Number 19A

Honourable W. M. Nickle, Minister,
Department of Planning and Development,
Parliament Buildings,
Toronto, Ontario.

Honourable Sir:

I take pleasure in transmitting
herewith the complete Conservation Report for the
Otter Creek.

The report covers History, Land,
Forestry, Water and Wildlife.

Yours very truly,

A. H. Richardson,
Chief Conservation Engineer

Toronto, March 26, 1957

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TABLE OF CONTENTS

Letter of Transmittal	
Conservation Branch Staff	
Authorship	
Acknowledgements	
Table of Contents	
List of Illustrations, Tables, Charts and Maps	
Introduction	
Recommendations	

PART I - HISTORY

Chapter 1	The Indians and the French	Page 1
Chapter 2	Early Surveys and Settlement along Lake Erie	Page 8
	Burford	" 11
	Oxford East, Windham	" 12
	Dereham and Norwich, Houghton	" 13
	Bayham and Malahide, Middleton	" 14
Chapter 3	The Talbot Settlement	Page 24
Chapter 4	Growth and Development	Page 31
	Villages and Other Communities	" 31
	Tillsonburg	" 31
	Vienna	" 41
	Norwich	" 45
	Port Burwell	" 49
	Bayham Post Office (Richmond)	" 58
	Willsonburg	" 62
	Corinth	" 63
	Otterville	" 64
	Burgessville	" 70
	Cornell	" 72
	Springford	" 73
	Milldale	" 75
Chapter 5	Mills	Page 77
	Mills in Bayham	" 80
	Mills in Dereham	" 83
	Mills in Houghton	" 86
	Mills in Malahide and Middleton	" 87
	Mills in Norwich North	" 88
	Mills in Norwich South	" 89
Chapter 6	Churches	Page 91
Chapter 7	Rebellion of 1837	Page 105
Chapter 8	Transportation	Page 110
	1. Roads	" 110
	2. Railways	" 120

TABLE OF CONTENTS

PART II - LAND USE

	Geographic Aspects of the Otter Creek Watershed	Page	1
	1. Introduction	"	1
	2. Bedrock Geology	"	1
	3. Climate	"	2
	4. Physiography	"	4
Chapter 1	Little Valleys	Page	1
	1. Introduction	"	1
	2. Little Valleys	"	2
	3. Soil and Water Conservation	"	5
	4. The Branch Creek Drainage Area	"	5
	5. How the Valley was Surveyed	"	6
Chapter 2	Physical Land Conditions	Page	8
	1. Introduction	"	8
	2. Physiography	"	8
	3. Soils	"	9
	(a) The Soil Profile	"	9
	(b) Soils of the Watershed	"	13
	(c) Soil Erosion	"	17
	(d) Estimation of Erosion	"	20
	(e) Soil Erosion on the Watershed	"	21
	(f) Soil and Surface Drainage	"	22
Chapter 3	Land Use	Page	24
Chapter 4	Land Capability and Recommended Land Use	Page	30
	1. Land Capability	"	30
	2. The Land Capability Classes and Recommended Use	"	32
	3. Recommended Land Use Classes	"	33
Chapter 5	Conservation Practices	Page	40
	1. Introduction	"	40
	2. Crop Rotations and Cover Crops	"	41
	3. Drainage	"	42
	4. Improved Pasture	"	44
	5. Contour Cultivation and Strip-Cropping	"	46
	6. Terraces	"	47
	7. Grassed Waterways and Diversion Channels	"	48
	8. Farm Ponds	"	49
Chapter 6	Farm Planning	Page	52
	Farm Plan for Eldon Herner, Currie, Ontario	Page	55
	Cropping Plan	Page	60
	Comments on the Farm Plan	"	63
Chapter 7	Carrying out the Little Valley Program	Page	64

PART III - FORESTRY

Chapter 1	The Forest in the Past	Page	1
	1. At the Time of Settlement	"	1
	2. Clearing the Land	"	3
	3. Forest Products	"	4

TABLE OF CONTENTS

Chapter 2	Survey of Present Woodland	Page	9
	1. Survey Methods	"	9
	2. Forest Cover Types	"	10
	3. Condition of Woodlands	"	14
	4. Scrublands	"	15
Chapter 3	Markets and Marketing	Page	16
	1. The Timber Harvest	"	17
	2. Timber Sales	"	19
	3. Timber Sale Contracts	"	21
	4. Attempts at a Solution of the Marketing Problem	"	24
Chapter 4	Forest Conservation Measures in Progress	Page	29
	1. Private Planting	"	29
	2. Authority Forests	"	30
	3. County Forests	"	31
	4. Demonstration Woodlots	"	31
	5. Tree Farms	"	32
	6. Tree-Cutting By-Laws	"	32
	7. 4-H Clubs	"	34
Chapter 5	Some Forest Conservation Measures Required	Page	35
	1. Woodlot Improvement Projects	"	35
	2. Private Reforestation	"	37
	3. Otter Authority Forest	"	38
	4. Forest Research	"	40
	5. The Authority and Conservation Education	"	40
Chapter 6	Further Conservation Measures Required	Page	42
	1. Woodland Management	"	42
	2. Elimination of Woodland Grazing	"	43
	3. Forest Fire Protection	"	46
	4. Protection from Insects and Diseases	"	48
	5. Windbreaks and Shelterbelts	"	51

PART IV - WATER

Chapter 1	General Description of the Watersheds	Page	1
	1. Boundaries and Dimensions	"	1
	2. Municipalities	"	1
	3. Terrain	"	2
	4. Rivers and Main Tributaries	"	2
Chapter 2	Former Floods	Page	4
Chapter 3	Hydrology	Page	15
	1. Precipitation, Stream Flow and Run-Off	"	15
	2. Maximum Flows	"	17
	3. Unit Hydrographs	"	19
	4. Design Storms	"	20
	5. Low Flows	"	26
Chapter 4	Water Problems	Page	29
	1. Irrigation	"	29
	2. Pollution	"	32
	3. Flood Protection	"	34

TABLE OF CONTENTS

Chapter 5	Available Conservation Storage	Page 38
	1. General	" 38
	2. Reservoir Sites	" 39
Chapter 6	Community Ponds	Page 45
Chapter 7	Field Surveys	Page 47
Chapter 8	Summary	Page 49
<u>Appendix A</u>	Estimate of Irrigation Water Requirements, Delhi Area.	Follows Page 52
	Abbreviations, Equivalents and Definitions.	

PART V - WILDLIFE

Chapter 1	Introduction	Page 1
Chapter 2	Improving the Land for Wildlife	" 2
	1. Woodlands	" 2
	2. Cultivation Practices	" 2
	3. Cover Patches	" 3
	4. Ponds and Streams	" 4
	5. Present Species of Wildlife	" 5
Chapter 3	Fish	Page 7
	1. Introduction	" 7
	2. Methods	" 7
	3. The River Valley	" 8
	4. Permanence of Flow and Temperature Conditions	" 9
	5. Fish Distribution - List of Fishes	" 10
	6. Sea Lampreys	" 12
	7. Stream Improvements	" 15

LIST OF ILLUSTRATIONS, TABLES, GRAPHS AND MAPS

Oak Forests are typical on the sandy soils

Frontispiece

PART I - HISTORY

ILLUSTRATIONS

	Follows page
"Balloon View" of Norwich Village 1881	30
"Balloon View" of Tillsonburg 1881	
Trinity Church, Port Burwell 1836	48
Beechcroft, Port Burwell	
Otterville about 1874-76	63
Treffry Flour Mill, Otterville	
Clutton's Grist Mill, Vienna	77
"The McCurdy" Mill, Bayham Township	
Dam at Jeremiah Moore's Grist Mill	79
Site of Beatty's dam, Bayham Township	
The dam at Rock's Mills	
Rock's Flour Mill	82
Otter Valley Baptist Church	93
Edison Family Burial Ground	
Road established in 1882	114
Treffry's Dam at Otterville	

MAPS

Roads and Trails - 1820-1851	40
Known Mill Sites	85

GRAPHS

Population, Houghton, Middleton, Tillsonburg, Norwich, Port Burwell, Vienna	127
Township Population, Norwich, Dereham, Bayham	127

PART II - LAND USE

ILLUSTRATIONS

	Follows page
Fox profile near Otterville	13
Gullies cut the Stream Bank	
Irregular topography on the Moraine	17
The Till Plain is gently sloping land	
Good Sod protects the soil	27
The level, well-drained sands	
Restricted soil drainage	34
Poor drainage may kill the crop	
Drainage Ditches on Perth and Brookston Soils	
Horseradish and Millet are special crops	41
Pear Orchard and ground cover	

	Follows page
Grassed Waterways	47
Good land producing good crops	
Soil, Slope and Erosion	55
Mapping Symbols	
Land Use Capability	56
Farm Plan	59
The Planned Farm	62

MAPS

Municipalities	1
Physiography	4
Otter Creek Watershed	31

TABLES

Table I: Soils	14
Table II: Soil Type and Erosion	23
Table III: Slope and Erosion	23
Table IV: Present Land Use	25
Table V: Recommended Use Class Acreages	38

PART III - FORESTRY

ILLUSTRATIONS

	Follows page
The Beech-Hard Maple type	10
Silver Maple-White Elm swamps	
Pruning of Christmas trees	29
Fine young Pine plantation	
Steep slopes well protected	34
Removal of poor trees	42
Indiscriminate slashing	
Erosion on bare slopes	50
Windbreaks protect the crop	

MAPS

Recommended Authority Forest and Woodlot Improvement Projects	37
Otter Creek Watershed showing Areas Recommended and Existing Woodland	Folded in Back of Report

GRAPHS

Per Cent Woodland. Fuelwood Production.	}	8
Maple Products		
Forest Cover Types, by Townships	}	13
Forest Cover Types, Woodland Conditions		
Woodland Conditions by Townships		14
Land Classification - Total Watershed		15
Land Classification - Recommended	}	39
Authority Forest		
Windbreak Plan		51

TABLES

Remaining Woodland in per cent		3
Forest Products - County of Elgin	}	6
" " - County of Norfolk		
" " - County of Oxford:		
Maple Products		7
Forest Cover Types		12
Scrublands		15

PART IV - WATER

ILLUSTRATIONS

Highway No. 3, 1949	}	12
Borden Plant, February 1954		
Highway No. 3, February 1954		
Pond in Otterville Community Park	}	37
Settling Basin for cannery effluent		
Former Lake St. Joseph dam		
Small removable timber dams may be constructed		46

FIGURES

Fig. 1: Plan of Otter Creek Watershed	1
Fig. 2: Water Level Profile	3
Fig. 3: Hydrographs - Mean Daily Flows	16
Fig. 4: Spring Flow Hydrographs	18
Fig. 5: Summer Flow Hydrographs	18
Fig. 6: No.5, Lower Tillsonburg Reservoir	39
Fig. 7: No.5A, Upper Tillsonburg Reservoir	40

TABLES

Table I:	Permeability of Soil Types	2
Table II:	Watershed Drainage Areas in Square Miles	} 3

	Follows page
Table III: Maximum, Minimum, Mean Daily and Mean Monthly Flows - Otter Creek at Vienna	16
Table IV: Unitgraph Peaks for Otter Creek at Vienna for Selected Storms	19
Table V: Dam and Reservoir Data for Otter Creek Sites	44

PART V - WILDLIFE

ILLUSTRATIONS

	Follows page
Lake Lisgar, in Tillsonburg A trout stream The same trout stream	14
A trout stream near Glen Meyer Shallow section of a trout stream An excellent stretch of trout water	15

MAPS

Collection Stations for Stream Survey of 1955	7
Biological Conditions of Streams	9
Distribution of Game Fish	10

INTRODUCTION

Conservation has long been a subject of concern to the people of Ontario. This concern had to do originally with the protection of forests because of their importance as a source of revenue to the Province; but allied with this was the problem of wildlife management and the protection of source areas of rivers and streams. In Southern Ontario interest in conservation was indicated first by reforestation and woodlot management, but more recently this has broadened out to include flood and pollution control, improved land use and provision for recreation facilities.

While the progress in these activities has been steady up to the present, most of the programs heretofore were initiated by government departments. Recently, however, there has been a growing conception of personal obligation, especially where land use problems, farm ponds and small reforestation projects are concerned. On the other hand, control of flooding, summer flow and pollution; large reforestation projects; and recreation areas have come to be considered the responsibility of the community - the community in this case being the river valley.

With the advent of this new concept of personal and community responsibility in conservation, the Authorities movement was born, and the willingness of our people to undertake conservation in this way is indicated by the fact that in the last eleven years 17 Authorities have been established, with a total membership of 279 municipalities and an area of 12,217 square miles.

The first step in establishing a Conservation Authority is undertaken by all the municipalities wholly or partly within a watershed. Two such municipalities must first by resolution petition the Government to call a meeting for the purpose of ascertaining whether or not an Authority should be established. Two-thirds of the number of representatives

which the municipalities are entitled to appoint (on a population basis) must be present to make the meeting legal. If two-thirds of those present vote in favour of establishing an Authority a resolution is forwarded to the Government. The Authority is then established by Order-in-Council and under the Act becomes a body corporate, including representatives from all the municipalities in the watershed.

While some Authorities were brought into being because of flooding within their areas, all were aware of the necessity of carrying out such supplementary measures as improved methods of land use, reforestation, proper woodlot management, prevention of pollution, investigation of underground water supplies, wildlife studies and recreation. But the Authorities were not equipped to carry out the extensive investigations that would indicate where such work should be done. Consequently the Conservation Branch of the Department of Planning and Development undertook to carry out the preliminary investigations as a service to the Authorities, to appraise, by means of surveys and reports, the conservation needs of each watershed, and to submit to the Authority a detailed report outlining the conservation measures that should be implemented.

The survey work is grouped under five general headings, namely, Land Use, Forestry, Water, Wildlife and Recreation. The scope of the studies made in each of these subjects varies with the condition and needs of the area under investigation. In addition to the five topics indicated above, a study of the history of the area is incorporated. This serves as a backdrop to all the conservation problems of the watershed and compels the reader to understand the abuses of the past and the need for a diversified program in the future.

The starting point for all surveys is aerial photography. Before the survey is commenced in the field all

such contributing data as maps, old records, photographs, unpublished reports and other useful information are thoroughly explored and recorded. While the survey is in progress similar data are gathered locally, and agricultural representatives, zone foresters, municipal clerks and other officials and private citizens are interviewed for additional material.

The results of these conservation surveys, together with the recommendations based upon them, are set down in the reports presented to the Authorities and intended to serve them as a blueprint. The carrying out of any scheme is not the work of the Conservation Branch of the Department of Planning and Development, because it is not an operating department. Its active participation for the most part ceases when the planning is complete and the report is submitted, although it stands by to interpret the report and give advice and assistance in carrying out the plans recommended in the report. The Authority must assume responsibility for initiating the schemes which it considers most urgent; it must also make approaches to the government departments or other bodies from which it hopes to get assistance.

If, for example, an Authority undertakes a scheme having to do with land use, it must seek assistance from the Department of Agriculture; if it involves a forestry or wildlife problem, then the Department of Lands and Forests is approached. In the case of flood control, however, as there is no department of the Government doing hydraulic surveys except the Conservation Branch, whose staff is not large enough to carry through the engineering works of several Authorities, the Authority must engage a consulting engineer to do the final engineering and designing and to carry the work through the construction stage. Similarly, where an Authority undertakes a scheme which has to do with recreation, it may have to employ men specially trained in this work.

As the work being done by Authorities is a new approach to the conservation problem, in that the responsibility of carrying it out is left entirely in the hands of the Authority concerned, much directing and assistance have been necessary from the Conservation Branch and, in the case of 13 Authorities, a member of the staff of the Department of Planning and Development has been assigned to work in the watershed.

The Otter Creek Conservation Authority was established by Order-in-Council on August 5, 1954, following an organization meeting which was held at Tillsonburg on July 20, 1954, when 14 representatives out of a total of 14 attended the meeting and 12 voted in favour of establishing the Authority. The Authority's jurisdiction was extended on February 2, 1956, to include Little Otter Creek and all the small streams draining into Lake Erie from the east boundary of the Otter Creek Authority to the west boundary of Big Creek Region Authority.

As mentioned above, the Department of Planning and Development, as a service to an Authority, undertakes to carry out a conservation survey of the valley for the guidance of the Authority, but the commencement of conservation work in the valley does not necessarily have to wait until such a survey has been made and the report presented. This has been the case with the Otter Creek Conservation Authority, and much excellent work and planning have been done independently of the reports which have been prepared by this department.

- A. H. Richardson

RECOMMENDATIONS

RECOMMENDATIONS

STATED OR IMPLIED IN THIS REPORT

History

1. That, before carrying out any project, the Authority ascertain from the Royal Ontario Museum of Archaeology at Toronto whether the area concerned is likely to contain archaeological material and if necessary arrange for the investigation of the site before operations make this difficult or impossible.
2. That where records, buildings and objects exist of sufficient interest as illustrating the life of the watershed during the period of development, the preservation of these relics be considered an aspect of conservation; and that where such records and other relics are the private property of individuals and corporations within the watershed, the Authority take definite measures to encourage their preservation by their owners or by the commitment of these to proper care in libraries, museums, archives and other suitable repositories.
3. That when sites, buildings or ruins of structures, of this kind form part of, or are adjacent to, properties acquired by the Authority for flood control, reforestation or recreation, the possibility of including them in the scheme be considered.
4. That in such cases sites be marked, ruins preserved and buildings restored and used for some purpose in connection with the project compatible with retaining their original character.
5. That the Authority appoint an Historical Sites Advisory Board to make recommendations to it with regard to matters of historical interest, including the preservation of historical buildings and relics.

6. That from the large number of sites and buildings of historic interest (in the wider sense used in these recommendations) to be found within the watershed, a few be selected for eventual inclusion in the scope of the activities of the Authority, besides those connected with recommended projects.
7. That this selection include the sites of the mills known to have been in operation before 1840, of the first Forge at Tillsonburg, the deposits of iron in Dereham and Middleton Townships, and of some other early mills and factories; of some other buildings of historical interest that have been destroyed and some existing buildings interesting for their associations or age.
8. That a survey be carried out to ascertain what objects of historical interest exist in the watershed and how some of these may be preserved in the future.
9. That, wherever possible, the buildings be left on their original sites and continued in their original use or adapted to some suitable purpose in connection with the normal life of the community.
10. That the Authority provide as part of its recreation program an area or areas where buildings which it is desired to preserve may be re-erected when they cannot be retained on the original site.
11. That these recommendations be taken as applying especially to the old flour mill at Otterville and that the Authority consider such action as may be necessary to prevent the destruction or radical alteration of this building and the possibility of using the area around the mill and pond for historical purposes.

Land Use

12. That, to further the development of the little valley, the Authority obtain as fully as possible the assistance and co-operation of the individual farmers in the valley and also of local groups interested in better land and water conditions. p. 65
13. That the Authority promote the construction and installation of special conservation measures where these are deemed desirable. The grassing of waterways and the control of gullies are two items which should receive early attention. p. 38
14. That the Authority urge each farmer in the watershed to have his farm planned, and that the Authority consider employing a competent man for a short period for the purpose of carrying out the necessary extension work. p. 64

Forestry

15. That the Authority, under agreements with co-operators or through lease or purchase of suitable woodlots, undertake the development of Woodlot Improvement Projects to demonstrate the advantages of better forestry practice. p. 35
16. That an Otter Authority Forest be established and that it be expanded through a definite program of annual additions and planting until the total recommended area of 4,909 acres is acquired and reforested. p. 38
17. That the Authority encourage private reforestation by providing a planting service at nominal cost and/or offering a subsidy for approved private planting projects. p. 38

18. That the Authority, by purchase of equipment, organization of cutting crews, or direct subsidy, encourage private owners in thinnings and improvement cuttings in their woodlots. p. 43
19. (a) That the Authority investigate the Halton County fencing scheme and adopt such a modified scheme as seems most likely to result in elimination of woodland grazing. p. 45
(b) That the Authority publish a simple, attractive bulletin on the disadvantages of woodlot grazing. p. 46
20. That the Authority co-operate with schools, government departments and all other groups and agencies possible to publicize the need and the methods of reforestation and woodlot management; and in particular that the Authority sponsor tours, practical demonstrations and field days for this purpose. p. 41
21. That the Authority encourage and co-operate in research on the best methods of establishing and managing woodlands under local conditions. p. 40
22. That the Authority act as co-sponsor for:
 - (a) 4-H Forestry Clubs, p. 34
 - (b) the Tree Farm movement. p. 32
23. That the Authority assist in investigating and publicizing markets and marketing methods for woodlot products to encourage:
 - (a) maximum use of low-grade materials from thinnings and improvement cuttings, p. 16
 - (b) closer and more uniform appraisal of timber, whether standing or in the log, p. 17
 - (c) marking of trees for removal, p. 33
 - (d) securing of competitive bids for timber, p. 20
 - (e) insistence on a written Timber Sales Contract. p. 21

24. That the Authority investigate and urge the implementation of the best method of providing fire protection for wooded areas within the watershed in co-operation with the Department of Lands and Forests. p. 47
25. That the Authority encourage the establishment of wind-breaks and shelterbelts. p. 53

Water

26. That conservation storage reservoirs be considered in order to regulate the spring run-off and store water for use during the drier summer months. p. 30
27. That a detailed ground water study be made to determine the potential water yield from this source. p. 31
28. That some action be taken immediately to acquire the lands of the recommended reservoir sites in order that they will be available when required. p. 32
29. That improvements be made in the treatment of both industrial and municipal wastes. p. 33
30. That a permit system be established for the construction of all new effluent pipes or drains, large or small, which would empty into watercourses or natural bodies of water. p. 33
31. That an extensive education program concerning pollution control be directed to both individuals and corporations. This should include the need for prevention of the dumping of refuse along the edges of or in the rivers. p. 34
32. That a Pollution Advisory Board be formed within the Authority which would make a special study of some of the needs as outlined in Chapter 4 of this report. p. 34

33. That the practice of channelling through the heavy ice sheet at the mouth of the river be continued to prevent ice jams. p. 35
34. That the Authority establish a flood warning system and appoint observers at strategic points along the river to alert the people farther downstream. p. 36
35. That every precaution be taken to prevent any further encroachment on the flood plains. p. 37
36. That the construction of the Lower Tillsonburg Dam and Reservoir be given early consideration. p. 41
37. That the remaining dams and reservoirs be constructed as required. p. 40
38. That a series of community ponds be constructed throughout the watershed. p. 45

Wildlife

39. That the stocking of fish in this watershed be restricted to those streams which have been shown on the map accompanying this report to be suitable for the species concerned. p. 9
40. That a Fish and Wildlife Advisory Board of the Authority investigate and report on the subject of keeping a permanent flow in those stream courses which are injuriously affected by depletion from irrigation. p. 9

HISTORY

CHAPTER 1
THE INDIANS AND THE FRENCH

In the year of Our Lord 1615, when Samuel de Champlain first visited the country that is now the Province of Ontario, he found the Huron Nation occupying the lands lying between Lake Simcoe and the Georgian Bay. It was Champlain's purpose "to continue the exploration of the country, to learn the language, and form relations and friendships with the leading men of the villages and tribes, as well for the glory of God as for the renown of the French". From the Hurons, and from their neighbours, the Ottawas, whom he visited in the Bruce Peninsula, Champlain learned of the Neutrals, or Attiwandarons,* whose nearest villages lay a few days' journey from the Huron country.

"There is, also" he writes, "at a distance of a two days' journey from (the Petuns), in a southerly direction, another savage nation, that produces a large amount of tobacco. This is called the Neutral Nation. They number four thousand warriors, and dwell westward of the lake of the Entouhonorons (Lake Ontario), which is from eighty to a hundred leagues in extent.With the Iroquois and our allies (the Hurons) they are at peace, and preserve a neutrality. There is a cordial understanding towards both these nations, and they do not venture to engage in any dispute or quarrel, but on the contrary often eat and drink with them like good friends. I was very desirous of visiting this nation, but the people where we were dissuaded me from it, saying that the year before one of our men had killed one of them, when we were at war with the Entouhonorons (Iroquois), which offended them; and they informed us that they are much inclined to revenge."†

Champlain determined to assist the Hurons in their wars against the Iroquois, and despatched the interpreter, Etienne Brulé, to enlist the aid of the Andastes, a nation dwelling near the headwaters of the Susquehanna River, in the present State of Pennsylvania. To reach the Andastes, Brulé had to pass through the hostile territory of the Senecas;

* Various written: Attikadaron, Atiouandaronk, Attiouandaron, Attiwandaronk and Attiwandaron. The name signifies "peoples of a slightly different language."

† Voyages of Samuel de Champlain, 1604-1618. New York, 1952. Page 304.

but so far as possible, he avoided them by following a route that led through the country of the Neutrals. From Lake Simcoe he followed the portage trail that brought him to the mouth of the Humber River: he was the first white man to see and travel on Lake Ontario; and presently, coming by canoe to the western end of that lake, he was the first to set foot in a wigwam of the Neutrals. Arriving finally among the Andastes, he persuaded that nation to send a force of five hundred warriors to join Champlain's attack on the Oneidas; but the Andastes deliberated too long, and their warriors arrived too late to prevent the disaster that sent Champlain and his dejected Hurons home to the Huron country. Brulé spent the winter of 1615-16 in exploring the regions between Lake Erie and Chesapeake Bay; he finally rejoined Champlain, and reported not only his observations on Indian tribal politics, but also the fruits of his extensive explorations.

The eminent and observant Jesuit, Francis Joseph Bressani, writing in 1653, gives the following account of the country of the Neutrals:

"To the south, on the shores of this great lake (Huron), dwelt the people whom we call the 'Nation of the Petuns', so named from the great quantity of tobacco which they raise and to which they give the name of petun. To the south, but leaning towards the east, dwelt the Neutral Nations. Their nearest villages to us, who live at Ossossane of the Hurons, are distant about one hundred miles. Their territory is about one hundred and fifty miles in length."*

These hundred and fifty miles would include all the land extending from thirty miles east of the Niagara River to the St. Clair flats.

The Franciscan priest, De la Roche Daillon, who visited the Neutrals in 1626, speaks of the favourable climate which their country enjoyed, and notes the abundance of deer, moose, panthers, bears, wild-cats, and squirrels in the forests.

* Annual Archaeological Report (Ontario, 1913). The Attiwandarons, or Nation of the Neutrals: page 13.

"The rivers furnish excellent fish, and the earth yields abundant crops. They have squashes, tobacco, corn, beans and other vegetables. Their real business is hunting and war. Their life, like that of the Hurons, is very impure and their manners and customs just the same."*

In the Jesuit Relation of 1640-41, Father H. L'Alemant furnished his superiors with a lengthy account of the Neutrals, and of the "Mission of the Angels," which Fathers Jean de Brebeuf and Joseph Marie Chaumonot undertook to establish among them.

"This nation is very populous; about forty villages or hamlets are counted therein. Setting out from our Huron people to reach the first and nearest villages, we travel four or five days, - that is to say, about forty leagues, - going always directly South. From the first village of the Neutral Nation which one finds on arriving there from this place, and continuing to travel South or Southeast, it is about four days' journey to the entrance of the so celebrated River of that Nation, into the Ontario or lake of St. Louys. On this side of that River, - and not beyond it, as a certain Chart indicates, - are the greater part of the villages of the Neutral Nation. There are three or four beyond, ranging from East to West, towards the Nation of the Cat, or Erieehronons.

"According to the reckonings of the Fathers who have been there, there are at least twelve thousand souls in the whole extent of the country, which relies upon being still able to furnish four thousand warriors, notwithstanding the wars, famine, and sickness which for 3 years have been unusually prevalent there.

"We have every reason to believe that not long ago they all made but one People, - both Hurons and Iroquois, and those of the Neutral Nation; and that they came from one and the same family, or from a few old stocks which formerly landed on the coasts of these regions. But it is probable that, in progress of time, they have become removed and separated from one another, in abode, in interests, and in affection; so that some have become enemies, some Neutral, and others have remained in some more special connection and communication.

"These Tribes which are Neutral between the Hurons and Iroquois, have cruel wars with other Western Nations, and especially with the Atsistaehronons, or Fire Nation, - from which they took last year a hundred prisoners; and this year having returned there for war with an army of two thousand men, they again brought away more than a hundred and seventy, toward whom they conduct themselves with almost the same cruelties as the Hurons do towards their enemies. However, they practise the further cruelty of burning the women prisoners of war, as well as the men, - which is not done by the Hurons, who either

* Archaeological Report (Ontario), 1913. Op. cit., page 15.

give them their lives, or content themselves with knocking them down in the heat of the moment, and bearing off some portion of their bodies,"*

Midway between the east and west limits of the country of the Neutrals, and facing the shore of Lake Erie, which formed their southern boundary, lay the watershed of the Otter Creek. None of the Neutral villages lying within the watershed has been identified by name; nor have the sites of the mission stations which the Jesuits established among them been definitely determined. But it is safe to say that the Otter Creek watershed lay close to the heart of the Neutral territory; that its soil bore a share of the peaceful husbandry and of the savage warfare in which the Neutrals engaged; and that it was the scene of some part of the labours, successes, and failures that attended the exertions of the Jesuit missionaries.

The plan of the Jesuits was to establish in the new mission "a fixed and permanent dwelling which should be the retreat of the neighbouring Missionaries," who would travel from its security into the villages of the surrounding country. But, from its very beginning, this mission to the Neutrals, for reasons beyond the control of the missionaries, was faced with troubles that, before many years had passed, brought the venture to a disheartening end.

The Hurons saw in the establishment of the "Mission of the Angels" a threat to the monopoly they had hitherto enjoyed of the fur trade with the French at Quebec; and they spread among the Neutrals malicious reports concerning the missionaries, the most damaging of which was the charge of sorcery. So effectual was the campaign of calumny that a council of Neutral chiefs formally refused to accept any presents the "black-robés" might offer.

"From village to village they passed, but everywhere the doors were barred to them. Hostile looks greeted

* The Jesuit Relations, 1640-41, Vol. XXI: page 187 et seq.

them wherever they went. No sooner did they approach a village than the cry resounded on all sides 'Here come the Agwa'. This was the name given by the natives to their greatest enemies. If the priests were admitted into their dwellings at all, it was more frequently from fear of the 'sorcerers' than for the hope of gain."*

After four months of sojourn in the midst of dangers and hardships "better imagined than described", the fathers abandoned their attempt to settle among the Neutrals, and returned to Ste.-Marie-among-the-Hurons; two years later, with gratifying success, Christian Indians visited the Neutrals and spread the faith among them.

In the end, it was the very ferocity of the Neutrals that led to their destruction. The Iroquois, by 1649, had destroyed or dispersed their ancient enemies, the Hurons, some of whom had found refuge among the Neutrals. It was then that a chief of the Onondagas proposed to a Neutral warrior -

"that the young braves of the two tribes would meet in occasional combats in order to stimulate, from time to time, their warrior courage. The Neutral chief after repeated refusals at last consented, though reluctantly. In a skirmish which followed, an Iroquois warrior was taken prisoner and burned at the stake by the Neutrals. As there had been no actual war declared between the tribes, this mutilation and burning provoked the indignation of the Five Nations. The Onondagas, to avenge his death, entered upon the lands of the Neutrals, and the Mohawks and Senecas marched to the assistance of their countrymen."†

In the year 1650, the war between the Iroquois and the Neutrals was prosecuted with the ruthlessness and savagery for which both parties were notorious. The Senecas and Onondagas attacked a frontier town of the Neutrals, and captured or massacred 1,600 warriors and at least as many women and children. The following year they stormed another town, and after butchering the old men and children at the breast, carried off a number of prisoners, among them many young girls to be given as wives to Onondaga and Seneca warriors. In retaliation, the Neutrals captured a town of

* Coyne, James H. The Country of the Neutrals. In Historical Sketches of the County of Elgin. St. Thomas, 1895: page 15.

† Archaeological Report (Ontario), 1913. Op. cit., page 18.

the Senecas, killed and scalped two hundred men, and tortured and burned fifty prisoners. The next wave of Iroquois vengeance was the last and marked the end of the Neutral Nation. Fifteen hundred Iroquois warriors crossed the Niagara River, and in rapid succession stormed village after village, tomahawked and scalped the inhabitants, and returned to their own country with troops of prisoners reserved for adoption or the flames. The rest of the Neutral villages were struck with panic. They abandoned their homes and their hunting grounds, and fled to the west and north-west. Some of the tribal remnants found homes among the northern Algonquins. Others joined with the Andastes, and later were found taking part in a war against the Senecas. Some united with the survivors of the Hurons at Mackinac and on Lake Superior, and appear from time to time on the pages of history under the name of Wyandots. Their former territory on the shores of Lake Erie became part of "the beaver hunting grounds of the Iroquois".

For the ensuing few years, the country of the Neutrals lay deserted and almost unvisited. Claimed by the French, it was controlled by their enemies, the Iroquois; both exploration and missionary endeavour were at a stand-still, until gradually, the passage of the years and the potentialities of trade inclined the Five Nations to abate the ardour of their hostility, and to find ways of coming to terms with the French. In the words of J. H. Coyne:

"When the war of extermination urged by the Iroquois against their neighbours, the Eries and Susquehannas, left the conquering race isolated from the fur-bearing portions of the continent, diplomacy was brought into play. They craved peace with the French, in order that they might be free to tap the north-western fur trade as middlemen between the natives and the English. The Lower Lakes now became comparatively safe for travel, but in the absence of population their shores possessed no value in the eyes of the French, who passed them without thinking of exploring the interior."*

* Introduction to Gallinée's Narrative, by James H. Coyne. Ontario Historical Society Papers and Records, Vol. IV, 1903: page xix.

Peace between the French and the Iroquois was made in 1667, and lasted nearly twenty years. Jesuits, Sulpicians, and Recollets were encouraged to undertake new missionary ventures, and Church and State combined to explore and develop the resources of a vast French empire in the western world.

In 1669, the Sulpicians, Francis Dollier de Casson and René de Bréhant de Galinée, part of the time accompanied by La Salle, travelled from Montreal to the Iroquois country on the south side of Lake Ontario, and from thence to Lake Erie. Guided by reports brought to them by Jolliet, whose interest was in the fur trade, they were seeking a safe and easy route to the "nation of Ottawas called the Pottawattamies, amongst whom there had never been any missionaries". They passed the winter of 1669-70 near the site of the present village of Port Dover, in Norfolk County; and in the spring of 1670, partly by canoe and partly on land, they pressed on westward, passing one creek after another (including the Otter), until they came to where M. Jolliet had hidden a canoe, which he had told them how to find, probably on the banks of Kettle Creek. And so they proceeded into Lake Huron, and, abandoning their purpose of establishing a mission to the Pottawattamies, returned by way of the French and Ottawa Rivers to Montreal.

Once more the country of the Neutrals, the beaver hunting grounds of the Iroquois, was left deserted and forgotten. For the next hundred years almost nothing is heard of it.

CHAPTER 2

EARLY SURVEYS AND SETTLEMENT ALONG LAKE ERIE

The whole of the Otter Creek Watershed was included within a tract purchased, May 22, 1784, by the Crown from the Mississaga Indians, by a treaty which described the tract in the following terms:

"All that Tract or Parcel of Land, laying & being between the Lakes Ontario and Erie, beginning at lake Ontario, four miles South Westerly from the Point opposite to Niagara Fort, known by the Name of Mississaga Point (Niagara-on-the-Lake), and running from thence along Said Lake to the Creek that fall from a Small Lake into the Said Lake Ontario, known by the Name of Waghquata (Burlington Bay), from thence a North West Course until it Strikes the River La Tranche, or New River (Thames River), then down the Stream of Said river to that part or Place, where a due South Course will lead to the mouth of Catfish Creek, Emptying into Lake Erie, and from the above mentioned part or Place of the aforesaid river La Tranche, following the South Course to the mouth of the Said Cat Fish Creek, thence down Lake Erie, to the Lands heretofore Purchased from the Nation of Mississaga Indians, and from thence along the Said Purchase to Lake Ontario at the Place of Beginning as above mentioned, together with the Woods, Ways, Paths, Waters, Water Courses, advantages, emoluments, and Hereditaments whatsoever to the Said Tract or Parcel of Lands, Situated as above mentioned, belonging or in any wise appertaining."*

Few white men had ever travelled in the country thus described, and the description included a phrase that was found upon closer examination to be geographically impossible. In February, 1791, the surveyor Augustus Jones set out to run the line "Northwest from the outlet of Lake Geneva (another name for Burlington Bay), begun at a white Oak Tree", and having extended the line to a distance of 21 miles and 65 Chains, where it intersected a branch of the Grand River, he reported his progress to that point and awaited further instructions. In September and October of the following year,

* Ontario Archives, Crown Lands Papers, Shelf 14, No. 8: Paper No. 145. The text of the revised description, contained in the treaty of Dec. 7, 1792, is given in "Indian Treaties and Surrenders", Ottawa, 1891, Vol. I: pages 5-7.

armed with fresh orders, he extended the same line to a distance of fifty miles from Burlington Bay; and then, being convinced by his Indian guides that the north-west course could never intersect the Thames, he went south-west and then south until he finally struck the Thames at a point nine miles north of Woodstock. This roundabout line was established as the boundary of the purchase.

The western limit of the purchase was also a matter of some uncertainty. By the terms of the treaty, it was defined as a north-and-south line from the River La Tranche (the Thames) to the mouth of Catfish Creek. When, in 1790, the Chippawa and other chiefs at Detroit concluded a treaty by which they ceded to the Crown the lands between the Thames River and Lake Erie, eastward from the Detroit River, the eastern boundary of the tract in question was defined as a north-south line between the Thames and the mouth of Catfish Creek, "commonly called Rivière au Chaudière", "being the Western extremity of a Tract purchased by His said Majesty from the Messesagey Indians in the year One Thousand Seven Hundred and Eighty Four". Now the Rivière au Chaudière is not Catfish Creek, but Kettle Creek; and it is likely that the latter was intended to form the boundary. But the confusion in the names of these two creeks became a question of no practical consequence when the tracts on both sides of the uncertain boundary had been acquired by the Crown. And in any case, the lands embraced in the Otter Creek watershed were certainly part of the earlier purchase.

Before the division of Canada in 1791 into the two Provinces of Upper and Lower Canada, the country was divided into Districts; and the responsibility for locating settlers lay with the Land Board of each such District. All the territory lying to the westward of the eastern extremity of Long Point constituted the District of Hesse; and the Land Board of the District of Hesse was at Detroit, which had not at that time been ceded to the United States.

The Government surveyor at Detroit was Mr. Patrick McNiff and one of Mr. McNiff's troubles was that he had too many bosses, and his disposition was such that he managed to submit to the orders of any authority that claimed the right to command him in a way that seemed always to annoy one or another of his superiors. He asserted vehemently that he was subject to the authority of the Land Board; but on occasion the Commandant of the military post at Detroit gave him an order that he felt bound to obey: his letters are full of explanations of how obedient he must be to some other authority than the one he happened to be addressing.

On the 16th of June, 1790, Patrick McNiff, "pursuant to the order of Patrick Murray Esquire Commandant of Detroit &c.," set out along the shores of Lake Erie to examine and report the suitability of the lands between Detroit and Long Point for settlement. Ten days later he had returned to Detroit, and on June 26th handed his report to the Clerk of the Land Board. His report gives one of the earliest accounts of the lake-front appearance of the lands in the vicinity of the Otter Creek: his account is not flattering.

"From Pt. au Pins to the Portage at Long Point no possibility of making any Settlement to front on the Lake, being all the way a Yellow & white Sand bank from 50 to 100 feet high Top Covered with Chesnut & Scrubby Oak, and no Harbours where even light Boats may enter except River Tonty [Talbot Creek] & River a la Barbue [Catfish Creek]; a Load Boat may enter the Latter having $4\frac{1}{2}$ feet Water on the Bar; on each side of River a la Barbue are flats of excellent Land, but not above 15 or 20 Chains Wide before very high Land Commences which in many places does not appear to be accessible for any Carriage [i.e., for any mode of transportation]. On the Tops of these very high hills Good Land, Timber some large Chesnut, Hickery & Bass. These Hills are seperated by dry Ravines almost Impassible from their great Depth."*

It is believed that this unfavourable report led the Land Board at Detroit to encourage settlement along the Thames River rather than along the shores of the lake. The townships

* Survey Records, Department of Lands and Forests, Surveyors' Letters, Volume 3: No. 9.

based on Simcoe's new road from Burlington Bay to the Thames (Dundas Street) - Burford, Oxford and Windham - were the first of those comprised in the Otter Creek Watershed to be laid out; these were followed by Dereham and Norwich, and still later, by Houghton, Bayham, and Malahide. It was more than thirty years after the date of McNiff's report before the Township of Middleton was surveyed.

BURFORD On the same day that instructions were given to Augustus Jones, Deputy Surveyor, to lay out Dundas Street from Burlington Bay to the River Thames, March 19, 1793, the Surveyor General also issued instructions jointly to Augustus Jones and Lewis Grant to lay out the Township of Burford: "a Township Southerly of the afore mentioned Road, adjoining the Indian Land", that is to say, lying on the west side of the lands granted to the Six Nations Indians, bordering the Grand River. In his "History of Burford", Major R. Cuthbertson Muir states that

"Abraham Dayton, who received a grant of the township of Burford from Governor Simcoe, had been a resident of the State of New York, and was one of a religious sect, which through the influence of its leader, Jemima Wilkinson, had drawn together a considerable body of free thinkers, undecided characters and disgruntled members of other Christian bodies. These followers of Jemima Wilkinson were looked upon by the inhabitants who surrounded them, as a set of religious fanatics; and they decided at last, like the followers of Joseph Smith at a later date, to seek out a 'New Canaan', under the flag where all manner of religious beliefs are tolerated,

"The choice of an emissary was left to their leader, who deputed Abraham Dayton, a man of considerable ability, to proceed to Canada, and interview the Governor of the new Province, and propose the emigration of the whole body of worshippers, who desired to settle all together and by themselves, somewhere in the interior of the country.

"Gov. Simcoe believing them to be Quakers, a society well known to him in the old country, as quiet, law abiding and peaceable citizens, gave his assent to the proposition, and Dayton was authorized to proceed to the country lying west of the Indian lands along the River Ouse (Grand River).

"The promised land was found in what is now the township of Burford. The beautiful open park-like plains which met his eye appealed to Dayton so

"strongly, that he wisely decided, after the grant had been made under certain conditions, to cut loose from his old associates, and take up land in the township on his own account."

On the 29th of July, 1794, instructions were issued to Abraham Iredell, Deputy Surveyor, to lay out four concessions in "Dayton's Township"; and two months later, Augustus Jones was instructed to lay out an additional two concessions. The Otter Creek drains the westernmost eight or ten lots in Concessions 11, 12, 13, and 14, comprising about one-eighth of the entire township.

OXFORD EAST Augustus Jones surveyed the Township of Oxford in August and September, 1794, part of the time being unwell with fever and ague; he was finally obliged to quit the survey without completing it. Another surveyor, Charles Whiting, carried forward the survey, still without distinguishing between Oxford East and Oxford West, in November, 1796. In February and March, 1798, Augustus Jones returned to this township; on April 14th, he reported that he "should have finished had not the Snow and waters been so exceedingly high that I could not Proceed". Besides all this, on April 11th, Jones had suffered a broken rib in falling from his horse. By the 7th of May, feeling somewhat recovered from his injury, he set out to complete the survey of Oxford; he was overtaken by a letter from the Surveyor General ordering him to go to York (Toronto) to perform some surveys required there. The first stage in his return brought him to the Mohawk Village (Brantford), where, before proceeding further he was married, May 12th, 1798, to "a young lady of that place, daughter to the noted Mohawk warier TERRIHOGAH". The survey of Oxford was completed by William Hambly, in 1800.

WINDHAM This was another township granted en bloc to a company of settlers. On the 4th of October, 1794, instructions were issued to Augustus Jones to survey the "Outlines of a township for Pierce & Associates, in the rear of

Mr. Dayton's immediately behind and adjoining to the same". But Jones was employed toward the end of 1794 in carrying out minor surveys in the Niagara Peninsula, and in office work at Newark (Niagara-on-the-Lake); the instructions were transferred to William Hambly, and the Township of Windham was surveyed between August and December, 1797.

DEREHAM and NORWICH. The Deputy Surveyor, William Hambly, surveyed these two townships between the first of July and the 9th of December, 1799. His instructions were dated April 29, 1799: "You will . . . cause the Townships of Dereham and Norwich to be surveyed with all possible dispatch. . . . The outlines of the Townships are to be run with the Line down the middle between Lots No. 14 & 15 - of 12 miles in depth, and every other Concession Line". Dereham Township was completed by Samuel S. Wilmot, in 1810; and the remaining lines of Norwich were run by Mr. Peter Lossing in 1821. Peter Lossing's plan of the township is still in the possession of members of the Lossing family; the legend, in the handwriting of Peter Lossing's son, Benson, reads as follows:

"In Some conspicuous place on the Map represent that this is the state of the Settlement in Norwich, U.C., in the Year 1821 . . . also that the unlocated Land is generally for Sale in the Township at about \$3 pr acre, Large Tracts for easy payments, the unsettled Lots, mark initials, also mostly for sale, the first purchase 15,000 acres within the Scratch'd line gave that one Colour different from all the rest to distinguish it in one view. The Soil generally throughout the Township such as to admit of a compact Settlement.

"The very great Haste for want of time must Subject the delineation to some small inaccuracy. But I believe it is nearly correct."

HOUGHTON In the winter of 1797-98, the Deputy Surveyor, Thomas Welch, of Charlotteville, was engaged in exploration for a proposed township lying to the west of Walsingham, to be called Houghton. On March 27, 1798, he reported the results of his exploration, and adds, "I had excessive bad weather while executing this business . . . the low grounds are all at

present very full of water". On June 4th, 1798, the Surveyor General ordered Welch to lay out the proposed township; it was a large township, and included the areas subsequently made into the Townships of Malahide and Bayham. In 1810, those areas were referred to as "the vacant Tract of Land between the Townships of Houghton and Yarmouth", and Mahlon Burwell, Deputy Surveyor, was ordered to survey that tract, "and to divide it if sufficiently extensive, into two townships . . . under the names of Malahide & Bayham".

BAYHAM AND MALAHIDE. These two townships, as has been shown in the foregoing paragraph, were separated from Houghton in 1810. In the previous year, Burwell had explored the tract, and had surveyed the shore line in front of what was then called Houghton; and he had laid out the Talbot Road through the Townships of Southwold, Yarmouth and Houghton. He surveyed the present Township of Malahide between July 22nd and September 10th, 1810, and completed his survey of Bayham by December 24th of the same year.

MIDDLETON Mahlon Burwell laid out the Talbot Road through Middleton Township in 1809-10. Not for another fifteen years was the rest of the township surveyed; in 1824, Burwell employed another surveyor, John McDonald, to perform this service, and the survey was reported as completed, February 28, 1825.

The Township of Burford, which was the earliest of ten townships to be surveyed, was also the first to be settled. This was to be expected along the northern boundary, the "Front" of the township, where the newly opened Dundas Street gave ready access; but it is true as well of the southern concessions, part of which are included in the Otter Creek Watershed. Patents were issued in 1798 to Thomas Powell, "son of Wm. Dummer Powell, Esq'r., Justice of the Kings Bench of this Province", who was probably an absentee owner.

Other absentee owners in this corner of the township were Abraham Nelles, of Grimsby Township, 600 acres; Robert Hamilton, of Niagara, 900 acres; and Archibald Cunningham, of Oxford Township on the Thames, 1,200 acres. In the first twenty years of the new century, there were sixteen patents issued to persons who appear to have been bona fide settlers. The absentees may have held their lands for a time, but sooner or later they would wish to dispose of them to purchasers who intended to occupy them. Between 1830 and 1841, in this part of Burford Township, fourteen hundred acres were granted to the Canada Company; to be sold in turn to settlers. Some of the lands that had been set aside at the time of survey as Government Reserves, either for the Crown or for the "support of a Protestant Clergy", were sold directly between 1850 and 1875. Finally, in this part of the township, there was one 200-acre lot granted to Kings College as part of the endowment which the Government provided for that institution, now the University of Toronto.

In the early spring months of the year 1799, the Government of Upper Canada was busy with plans for opening a road from York (Toronto) to Kingston, to be known, like its western counterpart, as Dundas Street. The cost of this new road was to be met by the sale of lands in two townships in which settlement had not yet begun: the Townships of Dereham and Norwich were recommended for this mode of disposal. On April 12th, 1799, the Acting Surveyor General, D.W. Smith, wrote to "His Honor Peter Russell, Esquire, President Administering the Government of Upper Canada, &c., &c., &c, in Council" in the following words:

"May it please your Honor!

In obedience to your Honors Commands to report two Townships suitably situated for sale, to defray the Expenses of opening Dundas Street, from York to the Trent, I am to inform your Honor, that there appears to me to be two situations fit for this purpose; The one, being in the 2nd Row of Townships in the County of Durham; - the other, the Townships of Dereham and Norwich in the County of Norfolk -

"which latter I should prefer in anticipating what produce may be expected, as it is more surrounded by Settlement than the rear Lands in Durham."

By a Minute of the Executive Council, of the 27th of April, 1799,

"it is therefore ordered, that the Townships of Dereham & Norwich be laid off in Blocks of 4000 Acres, by running every other Concession line, and one Line in the Centre of each Township."

The final result of the laying out of these townships was not quite the large block effect that the order suggested, for in each concession the usual one-lot-in-seven was reserved for the Crown, and another one-in-seven for the Clergy; and when, in 1800, Patents were issued to the grantees of large holdings, the actual blocks so granted were in no case more than four contiguous lots, and often consisted largely of scattered single lots, or of parcels of two or three lots each.

Patents were issued on September 4th, 1800, to five grantees, for a total of 33,000 acres in Dereham Township, as follows:

To John and George Ball	12,000 Acres
To the Honourable Robert Hamilton	6,000 Acres
To the Reverend Robert Addison	12,000 Acres
To the Honorable Peter Russell	3,000 Acres

Total 33,000 Acres

In Norwich Township, an even larger quantity of land was thus granted to large holders:

To William Willcocks	July 22, 1800	15,000 Acres
To the Rev. Edmund Burke	Sept. 4, 1800	3,000 Acres
To the Hon. Peter Russell	Sept. 4, 1800	6,000 Acres
To Angus McDonnell	Sept. 4, 1800	3,000 Acres
To George Landman	Sept. 4, 1800	3,000 Acres
To the Hon. Robert Hamilton	Sept. 4, 1800	9,000 Acres
To Capt. William Fitzgerald	Sept. 4, 1800	3,000 Acres
To the Rev. Robert Addison	Sept. 4, 1800	6,000 Acres
To the Rev. Edmund Burke	Mar. 15, 1804	1,200 Acres

Total 49,200 Acres

Thus, out of 134,400 acres, the estimated total of Dereham and Norwich Townships, 82,200 acres, or 61 per cent, came into the possession of only ten owners. Whatever contribution these ten men may have made to the opening of the road from York to the Trent, they had assumed the responsibility

for promoting the settlement of the greater part of two large townships; and the effect of their landlordship was, in some measure, to retard the settlement of the townships concerned.

In the Township of Dereham, between 1830 and 1841, about thirty Crown Reserve lots were granted to the Canada Company, for subsequent disposal to actual settlers. The Government sold the Clergy Reserve lots, sometimes entire, sometimes as half- or quarter-lots; and these sales took place, for the most part between 1850 and 1870. In the south-west quarter of the township, some forty-five 200-acre lots were granted, between 1810 and 1820, to bona fide settlers, many of whom were entitled to grants of 200 acres each as the sons and daughters of United Empire Loyalists; and another influx of "solid settlers" took place in the 1830's. The majority of these grantees came into Dereham from the townships about the Bay of Quinte, from the Niagara Peninsula, and from the vicinity of York (Toronto). A few claimed their grants by reason of military services performed during the War of 1812.

One of the earliest accessions of actual settlers in Norwich Township came about through the purchase in 1810, by Peter Lossing and his associates, of the 15,000-acre tract that had been granted in 1800 to William Willcocks. An account of this venture is told in the Centenary Souvenir Book of Norwich, published in 1910.

"During the year 1809, Peter Lossing came from Dutchess County, N.Y., to look for a suitable home for himself and family, and being informed that there were desirable lands opened up in Oxford County, he visited them and found that they suited him.

"He returned to Canada the same fall (1809), accompanied by his brother-in-law, Peter De Long, also of Dutchess County, and they purchased from Mr. Willcocks, of York (now Toronto), for 50 cents an acre, his entire tract of land, 15,000 acres, in the township of Norwich; and on the 14th of July, 1810, Mr. Willcocks deeded to Peter Lossing and Peter De Long, jointly, the land referred to, first releasing a mortgage that was held against the property by one John Gray. Having secured the property, these two pioneers returned to Dutchess County to make suitable arrangements for occupying their new homes."

Peter Lossing and his associates were members of the Society of Friends, and they established in the north-east quarter of Norwich Township a Quaker settlement, the influence of which is still, in 1957, a characteristic of the neighbourhood. When, in 1855, the Township of Norwich was divided into two townships, the Quakers made up the greater part of the east half of the new township of Norwich North.

Apart from the Quakers, there appears to have been only one grant of land made before 1820 to a settler, and even he seems not to have persisted long in occupation of his land. On October 27th, 1817, a Patent was issued to James Coffin, of the Town of Niagara, for Lot No. 6, in the fourth Concession of Norwich. Coffin is described as a Military Claimant, "Assistant Commisary General, reduced to half pay in this Province". On Lossing's plan of the township, made in 1820, Lot 6, in the 4th Concession, is marked with the names of Samuel Cornwell and Michael Stover. Joint ownership appears to have been a common arrangement among the Quakers; Lossing's plan shows no less than twenty-one lots in his quarter-township bearing two owners' names.

The sale of Reserve lots took place in Norwich, as in other townships, during the 1850's and 1860's; the Canada Company received twenty-eight lots; and seventeen lots, or 3,400 acres, were granted as part of the endowment of Kings College. In the course of time, most, if not all, of these lots came into the hands of actual settlers; but the transactions took time.

From the time of their separation from the Township of Houghton, in 1810, the Townships of Bayham and Malahide followed similar patterns of settlement and development. Bayham lies mostly within the Otter Creek Watershed; and Malahide lies mostly outside the watershed.

In both townships, approximately half the land had been taken up by actual settlers by the year 1840; and in each there remained a few remnants of land not granted

until after 1900. Across both townships, at a distance of about eight miles from the Lake Erie shore, ran the Talbot Road, with a settlement pattern of its own. Both townships present a rather rugged terrain, with similar problems and similar solutions.

In the Township of Bayham, thirty-six lots, totalling about 7,000 acres, were granted to the Canada Company, four lots (800 acres) to Kings College. Colonel Mahlon Burwell, the Deputy Surveyor, received 1,200 acres of land scattered through the first four concessions, of which 1,000 acres were part of his pay for his work as a surveyor in laying out the township; contrary to a popularly received opinion, he did not have his choice of the best land, but drew his lots at random "out of a hat". In addition to his compensation lands, Burwell bought one Clergy Reserve lot, No. 12, in the first concession; he received his Patent for this lot March 17, 1834, and proceeded to lay out upon it the village of Port Burwell, to build a church, and to promote the growth of a lakeport community.

The dates of the Patents of lots on the Talbot Road, although generally from five to ten years later than the original dates of location by Colonel Talbot, were nevertheless, on the average, some ten years earlier than the Patent dates of lots in other parts of the township. As a consequence, the Talbot Road served not only to provide access to lands on and near its course; it also served as an inducement to settle, since one of the attractions the intending settler looked for was the existence of an already established settlement, where he would have, not only avenues of communication, but also the advantage of proximity to neighbours.

An examination of the dates of Patents of lots along the Talbot Road shows a general tendency for the lots to the westward to be earlier, and those to the eastward to be of later date: the lots in western Malahide Township were

patented, for the most part, in the early 1820's, those in the eastern third of the same township in the middle 1830's; lots on the Talbot Road in Bayham Township were patented earlier by nearly twenty years than those in the Township of Middleton. Thus it appears that Colonel Talbot, from his home (and office) in Port Talbot, seven miles west of Port Stanley, located his settlers progressively farther and farther from that focal point; for the majority of settlers on the Talbot Road are indicated as "located by Col. Talbot".

It should also be noted that, with few exceptions, the lots on the Talbot Road were granted only to actual settlers. None of them was included in the prescribed quantity of Crown and Clergy Reserves: these had to be located elsewhere. None of them was granted to the Canada Company, or to Kings College: such grants came only from the Crown Reserves. None of them was granted to the surveyors as compensation for surveys performed: they were excluded from "the hat". None of them was included in the large grants to absentee owners. Those that were not "Settlers located by Col. Talbot" were chiefly the sons or daughters of United Empire Loyalists. In a few cases, the Domesday records give only the name of the grantee, and give no indication of the nature of his claim. In the Township of Middleton, some lots on the Talbot Road were granted, by "Sale of Crown Lands", to lumber merchants; in one such case, Lots 165 to 171, inclusive, on the north side of Talbot Road, in Middleton, were sold to "William Mills, of the City of Hamilton, Esquire, who has paid £717 . 10 . - ." These are Lots No. 24 to 30 in the township system of numbering, and lie immediately to the eastward of the village of Courtland, between the surveyed line of the Talbot Road (a little to the northward of the present No. 3 Highway) and the township line between Middleton and Norwich South.

The Townships of Middleton and Houghton were relatively late in settlement, principally because they had been designated as "School Townships", and (with the exception of lots on both sides of the Talbot Road) withheld for many years from sale or grant to settlers.

As early as the year 1799, the Executive Council of Upper Canada had "selected ten Townships, to be appropriated for the purpose of establishing Grammar Schools, and other places of Education in this Province". Five School Townships lay to the eastward of the Capital (York), and five to the west: these were Seymour, Plantagenet, Bedford, Hinchinbrooke, and Sheffield to the east; and Houghton, Southwold, Westminster, Blandford and Middleton to the west. In the letter, dated 13 April, 1799, in which the Surveyor-General submitted the names of the townships he recommended, he added the further recommendation: "that whenever these Townships may be exposed to Sale, One to the Eastward and One to the Westward of the Capital, may be put up at the same time". His letter continued:

"And it may not be improper to mention, that I have been induced to appropriate Plantagenet, Houghton & Southwold. altho' there are a few locations therein, to seeking for situations altogether unbroke in upon, as they must be more remote, and consequently of less value. Besides, I have hopes that upon actual Survey, those Townships will be found to contain 45,000 Acres each, exclusive of the Locations already made, as they fill up spaces, which appear, from the information hitherto received, to be somewhat larger than the ordinary Townships."*

Settlement of the lots on the Talbot Road in Middleton Township was not subject to the restrictions that applied to the School Townships in general. The following comparison will serve to show the differences between the dates of Patent of actual settlers on the Road and those in other parts of Middleton.

* Ontario Archives, Crown Land Papers, Shelf 19, No. 7: Surveyor-General's Reports, Volume 1, pages 474-476.

	<u>On Talbot Road</u>	<u>Not on Talbot Road</u>
Patent dates (range)	1820 to 1867	1832 to 1899
Date when 50% of lots patented	1848	1860
Date when 75% of lots patented	1850	1866

In terms of averages, the settlement of the Talbot Road in Middleton Township was about fourteen years ahead of the settlement of the rest of the township.

The comparisons given above refer only to lots occupied by bona fide settlers. In 1825, Mahlon Burwell received his Patent for 1,667 acres of land in Middleton as his "compensation lands" for the survey of the township; and between 1831 and 1841, more than 7,200 acres in Middleton were granted to the Canada Company.

Houghton, the other School Township that is partly within the Otter Creek Watershed, was still later in settling. Apart from the nine lots in this township that front on the Talbot Road, eight lots (1,505 acres) granted to Mahlon Burwell as compensation for his survey of the township, and thirty-five lots granted between 1830 and 1846 to the Canada Company, the lands in Houghton were granted in 321 separate lots of varying size; the following figures may be compared with those given above for the Township of Middleton.

Patent dates (range)	1806 to 1955
Date when 50% of lots patented	1874
Date when 75% of lots patented	1883

Again, in terms of averages, the settlement of Houghton Township is shown to have been about fifteen or sixteen years later than the settlement of Middleton.

The course of settlement in Upper Canada was subjected to a serious set-back during the War of 1812. For more than two years of the war, from June, 1812, to November, 1814, the actual fighting did not take place within the limits of the Otter Creek Watershed. The Counties of Norfolk and Middlesex contributed their quotas to the militia forces,

and these saw action in the Niagara Peninsula and between London and Detroit. At the same time, the survey of lands in the province, and the business of locating settlers on the "Waste Lands of the Crown" were almost at a stand-still.

In November, 1814, the raid carried out by a band of some seven or eight hundred Kentuckians under the command of Brigadier-General McArthur brought the war to the very homes of the people settled in Norfolk and Middlesex Counties. Passing through the Townships of Delaware, Westminster, Oxford and Burford, the raiders burned the houses, barns, and mills of those who had actively opposed their march. At Burford they learned that the local militia had fallen back to Malcolm's Mills, near the village of Scotland; McArthur had spread reports to the effect that his destination was Burlington Bay, at the head of Lake Ontario, but when he found the waters of the Grand River swollen, and the ferry destroyed, he changed his plans and moved toward Malcolm's Mills, with the intention of destroying all the mills in the vicinity of the Grand River and in the Long Point Settlement. Avoiding an engagement with the militia, he proceeded to carry this intention into effect, and succeeded in destroying all the mills except two - Tisdale's, in Charlotteville Township, and Backhouse's, in Walsingham.

Returning by way of the Talbot Road, McArthur reached Detroit on November 17th, where he reported that

"they have penetrated two hundred miles into the enemy's territory, destroyed two hundred stand of arms, together with five of their most valuable mills, parolled or dispersed the greater part of the efficient militia of that part of Upper Canada west of the Grand River, and the whole detachment has returned to this place (Detroit) with the exception of one killed".

CHAPTER 3

THE TALBOT SETTLEMENT

In the Domesday records of Upper Canada, in the present Department of Lands and Forests, the names of three hundred and one settlers in the Townships of Bayham, Houghton, Malahide, and Middleton are marked with the notation: "Located by Colonel Talbot". In the Township of Bayham, Talbot's settlers were assigned land throughout the township, but in Houghton, Malahide, and Middleton, they occupied only such lots as fronted on the Talbot Road. The numbers of Talbot's settlers in these townships were as follows: Bayham, 158; Houghton, 8; Malahide, 60; Middleton, 75.

The region known as the Talbot Settlement was still a forest wilderness when, on the 21st of May, 1803, Thomas Talbot, with four followers, landed at the mouth of the little stream in the Township of Dunwich which has ever since been known by his name. By way of a formal taking possession, his first act was to seize an axe and with his own hands to chop down the first tree, thus inaugurating the establishment of his rule in his new "principality".

Thomas Talbot was born in Malahide Castle, in Ireland, July 19th, 1771. He was eighteen years of age when, as a lieutenant in the 24th Regiment, he first came to Canada in the spring of 1790. From 1791 to 1794, he served as secretary and aide-de-camp to Lieutenant-Governor Simcoe, and, in this service, accompanied the Governor on his overland journey from Niagara to Detroit and back, in February and March, 1793. He was thirty-one years of age when he set about the business of conquering the forest wilderness and converting it into a community of farms and villages, the most ambitious and the most successful scheme of settlement ever to be undertaken in any part of Upper Canada.

"The terms of his grant were laid down in a despatch from Colonial Secretary Hobart, to Lieutenant-Governor Hunter of Upper Canada, dated 15 February 1803. Hunter

was directed to arrange a grant to Talbot of 5,000 acres in the township of Yarmouth, or in case it was already appropriated, in any other that he might select. In addition to this, 'a proportion of the said township immediately contiguous' to the grant was to be reserved 'for the present,' to be granted to him at the rate of 200 acres for every family from Europe or America he might induce to settle there, provided he had already surrendered to it fifty acres of his 'Original Grant.' The words 'Original Grant' apparently applied to Talbot's 5,000 acres, and would restrict the number of his settlers to 100, the number of fifty-acre lots that could be carved out of 5,000 acres. They would also limit to 20,000 acres the amount of land that he could receive from the reserved part of the township after he had given up all of his original grant. But Talbot had requested an arrangement by which he would receive 150 acres out of each 200-acre lot in the township exclusive of his 5,000 acres, after he had placed a family on the other fifty acres of the lot, making the total amount that he could receive at least 50,000 acres. This would also scatter the settlers throughout the township, rather than concentrate them in a small area. Talbot always insisted that this was the intention of Lord Hobart's despatch."*

To the little community that grew up at the mouth of Talbot Creek he gave the name of Port Talbot; his "castle" ("a long wooden building, chiefly of rough logs, with a covered porch running along the south side") he called Castle Malahide. The beginnings of his settlement operations took place with discouraging slowness in the Townships of Dunwich and Aldborough. Gradually gaining momentum, his scheme grew to unprecedented proportions, and additional townships were placed under his superintendence for settlement. "By the year 1835 these numbered 28 in all, including 540,443 acres actually under patent or under cultivation."

In the year 1809, with a view to making easier access to his settlement from the more easterly parts of the province, and of enhancing the value of the lands through which it would pass, Talbot proposed a plan for completing a road from the Township of Middleton, through Houghton, Yarmouth, and Southwold, to Dunwich. By removing the Crown and Clergy Reserves from lots along the line of the proposed road, he would be able to locate actual settlers on all the lots on both sides of the road, and would require the settlers to

* Hamil, F.C. Colonel Talbot's Principality. Ontario History, Volume XLIV (1952): page 183.

perform the labour of clearing the road and of making it passable for vehicles. The Committee of the Executive Council to whom the proposal was referred reported favourably upon Talbot's petition, and remarked:

"that the Western parts of this Province where that Road is proposed to pass is very thinly inhabited; that the Communications between the Settlers are very difficult and sometimes dangerous; and that in no part of the Province is the want of facility of intercourse more sensibly felt and Experienced. The Committee likewise think it necessary to remark, that, as the Two Hundred and fifty pounds have already been Expended in the making of that Road, should the design of continuing it be frustrated, that Money would be entirely lost to the Public; and it is to be added, that facility of communication and vicinity of Settlement must very much increase the value of the large adjoining Block of Land set apart as a Fund for the erecting of Public Schools."*

Thus came into being the main east-west artery of communication that came to be known as the Talbot Road, upon which, as was shown in the previous chapter, settlement proceeded at a rate approximately fifteen years in advance of the settlement of the adjacent lands not situated on the road.

The arbitrary and sometimes informal methods used by Colonel Talbot in placing his settlers on their lots gave rise to considerable irritation and difficulty. It was Talbot's pride that he could dispense with the protracted and tedious procedures by which the regular business of granting land to settlers was attended in the offices of the Government: a plan of each township, a pencil, and a piece of India-rubber were all the machinery he required. (The India-rubber was necessary in order to remove delinquent applicants from the lots to which he had tentatively assigned them!). On the one hand, his methods offended the Surveyor-General and other officers of the Crown; they wanted records, returns of locations, returns of fees due and fees collected; they wanted evidence of the eligibility of each applicant for the grant of land he was seeking. To all this, Talbot turned a deaf ear: he was too busy locating settlers and more

* Patent Office, Department of Lands and Forests. Order in Council Book 3: page 131.

settlers to take time to make the kind of returns the Government wanted; in fact his methods were so much more successful than theirs for no other reason than that he employed simpler procedures than did they. On the other hand, his too easy dependence upon the pencil and rubber meant that the settlers had no other security of tenure than the rather dubious assurance that, if they pleased the Colonel, they could keep their lands. It is not surprising that many of them found this security insufficient.

The wind happened to be blowing in Colonel Talbot's favour at the time when Francis Gore, Esquire, Lieutenant-Governor of Upper Canada, directed the following note of instructions to be addressed to Thos. Ridout, Surveyor-General.

"6th October 1815

"Sir,- The Lieut. Governor desires that the Lands which were placed under the care of Colonel Talbot, in the London and Western districts, shall continue to remain under his charge, and you are not to allow of any Location on the lands described as below, but by that Gentleman, vizt. Talbot Road - Road from Talbot Road to Westminster - Townships of Bayham, Malahide and Yarmouth.

"William Halton, Sec'y.

"P.S. Have the goodness to acknowledge the receipt of this letter. W.H."*

A year and a half later, in a further order addressed to the Surveyor-General, the Lieutenant-Governor undertook to impose some sort of regulation upon Talbot's operations:

"10th March 1817

"Sir,- I am Commanded to signify to you the Lieut. Governors desire that if Colonel Talbot has not already furnished you with a Return of the names of the Persons who may have been located in the townships under his Superintendence, since the 10th of November 1815, (the date of the last return reported) you forthwith communicate to him His Excellencys wish that one be transmitted to you with as little delay as possible for His Excellencys information.

"Edw. MacMahon."†

* Patent Office, Department of Lands and Forests. Order in Council Book 3: page 359.

† Ibid., page 506.

Lieutenant-Governor Gore's retirement took place in June, 1817, and, until the arrival of Sir Peregrine Maitland as his successor in August, 1818, the Honourable Samuel Smith served as Administrator of the Province of Upper Canada. The Executive Council was renewing its efforts to bring Colonel Talbot under its control when they addressed the following report to the Administrator.

"In Council, 8 November 1817

"His Excellency Lieut. Governor Gore called upon Mr. Talbot for the deposit of Fees and Survey Money in all Locations made by him not only in the Talbot School township road but in the townships of Bayham and Malahide and restored those townships to the ordinary course of Location, which it is the object of Colonel Talbot's memorial to continue to withhold.

"The Council therefore cannot advise your Honor to accede to his prayer but humbly recommends: -

"That the actual Locations in Bayham and Malahide as well as on the road be ascertained, the state of the Improvement and of the Road, as also who have paid and who is in arrears for Survey money and Patent Fee, in order that after six months from such Report the Lots for which payment has not been paid or upon which the settlement duty has not been in progress may be opened for general Location by the Surveyor.

"That in the meantime until such Report be had that all Location on the Road and in Bayham and Malahide be suspended to obviate the difficulties which might as heretofore accrue from double locations by distinct and several authorities."

The success of the Talbot Settlement was the result chiefly of the almost fanatical drive with which Colonel Talbot performed the exacting task of meeting his applicants and assigning to them their lands. While the demands of the Government annoyed and irritated him, he managed in some measure to comply with their requirements, partly because that was the only way for his settlers to receive their Patents. The constant pressure of eager new applicants kept him busy filling his townships; the returns he had to make to the Government hindered his progress. Even apart from the time it would take to record his operations and to submit his returns, the very thought that anyone had the right to exercise control over him and to call him to account

exasperated him. On the other hand, his sweeping repudiation of regulation and control must often have proved exasperating to the Governors and Members of the Executive Council who, throughout the half-century of his regime, had to deal with him.

In the summer of 1837, Mrs. Anna Jameson visited the Colonel at Port Talbot, in order to satisfy her curiosity concerning "this immense settlement, the circumstances to which it owed its existence, and the character of the eccentric man who founded it." The following passages are taken from her account of her visit.

"This remarkable man is now about sixty-five, perhaps more, but he does not look so much. In spite of his rustic dress, his good-humoured, jovial, weather-beaten face, and the primitive simplicity, not to say rudeness, of his dwelling, he has in his features, air, and deportment, that something which stamps him gentleman.

"Colonel Talbot's life has been one of persevering, heroic self-devotion to the completion of a magnificent plan, laid down in the first instance, and followed up with unflinching tenacity of purpose. For sixteen years he saw scarce a human being, except the few boors and blacks employed in clearing and logging his land: he himself assumed the blanket-coat and axe, slept upon the bare earth, cooked three meals a day for twenty woodsmen, cleaned his own boots, washed his own linen, milked his cows, churned the butter, and made and baked the bread. For many years he solemnised all the marriages in his district!

"He has built his house, like the eagle his eyry, on a bold high cliff overhanging the lake. On the east there is a precipitous descent into a wild woody ravine, along the bottom of which winds a gentle stream, till it steals into the lake: this stream is in winter a raging torrent. The storms and the gradual action of the waves have detached large portions of the cliff in front of the house, and with them huge trees.

"He has sixteen acres of orchard-ground, in which he has planted and reared with success all the common European fruits, as apples, pears, plums, cherries, in abundance; but what delighted me beyond everything else, was a garden of more than two acres, very neatly laid out and enclosed, and in which he evidently took exceeding pride and pleasure; it was the first thing he showed me after my arrival.

"'Charlesvoix,' said he, 'was, I believe, the true cause of my coming to this place. You know he calls this the "Paradise of the Hurons." Now I was resolved to get to paradise by hook or by crook, and so I came here.' He added more seriously, 'I have accomplished what I resolved to do - it is done. But I would not, if any one was to offer me the universe, go through again the horrors I have undergone in forming this settlement. But do not imagine I repent it; I like my retirement.'

"He has passed his life in worse than solitude. He will admit no equal in his vicinity. His only intercourse has been with inferiors and dependents, whose servility he despised, and whose resistance enraged him - men whose interests rested on his favour - on his will, from which there was no appeal. Hence despotic habits, and contempt even for those whom he benefited: hence, with much natural benevolence and generosity, a total disregard, or rather total ignorance, of the feelings of others; - all the disadvantages, in short, of royalty, only on a smaller scale."*

Control of his operations and possession of his maps and plans remained in the Colonel's hands until the day of his death. He scorned the attempts made from time to time to "relieve" him of their burden, attempts prompted partly by a desire to bring his operations into conformity with Governmental procedures, and partly by a sincere wish to lighten the old gentleman's load. One of the last of these unsuccessful attempts is represented by a Minute of the Executive Council, dated -

"In Council 10th March 1852

"On the Letter dated the 5th March 1852, of the Commissioner of Crown Lands suggesting, with the view of relieving Colonel Talbot from the further charge of the lands under his Superintendence, he be requested to transfer to the Crown Lands Department, the various Township Maps in his possession together with any Schedules of unpatented Locations and Minutes of information as to the occupation and improvement in regard to such Locations.

"The Committee recommend that the suggestion of the Commissioner of Crown Lands be approved and carried into effect."†

Colonel Talbot died at London, Canada West, (now Ontario), February 6th, 1853, and was buried in the cemetery of St. Peter's Church, at Tyrconnel, in the Township of Dunwich.

* Winter Studies and Summer Rambles in Canada. London, 1838, 3 volumes. Vol. II, page 158 and passim

† Patent Office, Department of Lands and Forests. Order in Council Book 10: pages 425-426.

CHAPTER 4

GROWTH AND DEVELOPMENT

VILLAGES, AND OTHER COMMUNITIES

The Otter Creek Watershed includes one incorporated town, three incorporated villages, two police villages, and twenty-one unincorporated communities, of which nine have post offices.

Tillsonburg

The Tillsonburg Observer of March 17th, 1864, records the death, on the 15th of the same month, of Mr. George Tillson, the founder of Tillsonburg, and in a long obituary notice gives an account of the founding of the village.

"It is this week our painful duty to record the decease of one of the first settlers in the Township of Dereham and the founder of this village - Mr. George Tillson, sen. Deceased was descended from a good old Puritan stock, a paternal ancestor being one of a company of pilgrims, who fleeing from religious persecution in England, landed on the shores of Massachusetts during or shortly after the year 1620. Mr. Tillson was born in Enfield, Mass., on the 25th of November, 1782, and was consequently in the eighty second year of his age. He came to Canada in 1822 as a partner in the firm of H. Capron & Co., of the Normandale Iron Works. In the fall of 1824 he set out on a prospecting expedition, and having arrived in this neighborhood, and discovering the magnificent water privileges which abound on the Otter Creek and its tributaries, selected as the scene of his future operations the present site of Tillsonburg. In December of the same year he returned, accompanied by B. Van Norman, Esq., and Messrs. N. Fairchilds and James Ranson, to make a final examination of the property and discover the number of the lots on which the privileges were situated. He then, in partnership with B. Van Norman, Esq., and a nephew of his own, the late Harvey Tillson, Esq., purchased these lots - 3, 4, and 5, in the 12th Concession of Dereham - from Dr. Baldwin, father of the Hon. Robert Baldwin. In the spring of 1825, he made a permanent settlement on this property, erected shanties, and finally removed his family to the spot. At this time the whole of the surrounding country was a dense wilderness, not a road of any kind existed, there were only six families in Dereham, and the nearest house was four miles distant. The difficulties in his way were more than sufficient to have deterred a less persevering man from the further prosecution of his scheme of settlement. But he was a shrewd, far-seeing man, and in the magnificent water privileges which abound in the neighborhood, he discerned the promise of future prosperity, and manfully set to work to remove the obstacles that beset his path. The greatest of

"these was the absence of roads, and his energies were first directed to the supplying of this most pressing want of his little colony, to enable it to communicate with the surrounding communities. This desire for good roads and the determination to possess them was his distinguishing characteristic, and was continually exercised during his long life to the great and lasting benefit of the farmers of Dereham and the surrounding townships. By his unceasing energy and perseverance he succeeded in laying out direct roads from Tillsonburg to London, Ingersoll, St. Thomas, Simcoe, and Brantford, which were even then centres of trade. Not only did he use his influence to have these roads established, but set the example of working upon them; and so long as he was able to go around, he might be seen daily examining his former work and making repairs where needed. Thousands of dollars from his private purse were expended in the same cause. Indeed we believe that to his efforts in road making is due the rapid settlement of this section of country which followed his labors. His own business of course suffered, but his philanthropic road schemes conferred vast benefits upon the whole farming community."

The foregoing account refers to Mr. Tillson's partnership in the Normandale Iron Works. An Indian in the employ of the Normandale works brought to Mr. Tillson information of a deposit of bog ore in Dereham Township; and the results of his exploratory investigations determined Tillson to erect a furnace on the banks of the "Big Otter Creek". In partnership with Benjamin Van Norman, he dammed the creek and built a forge; an over-shot water wheel provided the power to operate a double set of bellows which supplied the necessary air blast for the first "Bloomery Forge"* in the Township of Dereham. The little settlement came to be known by the name of Dereham Forge.

As soon as the forge came into production, Messrs. Leavitt and Hogan set up an axe factory on Bloomer Street, the busy main street of the village, where a commodity indispensable in the life of the pioneer was produced entirely from local materials, at two dollars apiece. It is related that one dozen of these Leavitt & Hogan axes was the price

* Bloomery: from bloom, a mass of iron after having undergone the first hammering. Bloomery is defined as "the first forge in an iron-works through which the metal passes after melting, and in which it is made into blooms". The Shorter Oxford English Dictionary.

paid for a village lot on the newly laid out Broadway. A further addition to the growing industry of the community was a sawmill, erected by Mr. Tillson.

Dereham Forge suffered a set-back when it was found that the supplies of bog ore were not as extensive as had been at first believed; and when ships from England began to make use of wrought iron as ballast, to be unloaded in Canada, and the price fell from one shilling per pound to six cents, the furnace could no longer be worked at a profit, and was compelled to discontinue operations.

By 1831, there were twelve heads of families in the Township of Dereham. These twelve held the first township meeting, and appointed Mr. Tillson a county commissioner of roads and bridges. "To him we owe all those diagonal roads which lead into the town."*

In the winter season of 1835-36, C.D. Inglesby organized a school for the study of sacred music, in which were enrolled two of George Tillson's sons, George, junior, then aged 20, and Edwin, aged 10. The first school for the teaching of the "three R's" was kept in a log house (the date is not given) that stood near the intersection of the present Tillson Avenue and Simcoe Street; the teacher was Miss Hannah Tillson. In 1836 a new school was erected, a frame structure near the corner of London Street and Broadway, which served the double purpose of school and "meeting house", and which was open to all denominations.

Another addition was made to the manufacturing industries of the village by the erection, in 1836, of a grist mill, by Benjamin Van Norman, who owned one quarter interest in the water privileges.

* Clipped from an unidentified Tillsonburg newspaper, dated March 19, 1892, and reprinted from the Tillsonburg Liberal, December 9th, 1886; found in the Tillson Family Scrap-Book, in the office of the E.D. Tillson Estate, Tillsonburg.

"The year 1837 marks the date of the survey of the village and its reception of its present name. Some desired to call it Tilsondale, but the strong desire of Mr. Tillson was yielded to, and it was named Tillsonburg.

"Jesse P. Ball, assisted by George Tillson and Mr. Fawcett (the Methodist minister), surveyed the place..... Mr. Ball declared the width of the streets, especially Broadway, to be a cruel waste of land, but the owner of the land was decided in his views on the matter."*

In addition to being the founder and a leading citizen of Tillsonburg, George Tillson was the father of a large family, several members of which carried on the tradition of leadership in the community for many years. While still a resident of the State of Massachusetts, Tillson had met and married, in 1809, Nancy Barker, of Exeter, Maine. To them were born nine children.

Harriet Tillson was born in 1810, in Penobscot County, Maine; in 1825, when she was fifteen years of age, she was married to Benjamin Van Norman, her father's partner in business. She died in Tillsonburg in 1841.

Hannah Ruggles Tillson was born in 1813, in Massachusetts; she was one of the first school-teachers in Tillsonburg. In 1837, she was married to Harvey Hogan, one of the proprietors of the axe factory on Bloomer Street. She and her two children, aged one and two years, died in 1841.

George Barker Tillson, born in 1815, in Massachusetts, was married in 1851 to Lousia E. Conat. He died in Tillsonburg in 1883. They had eight children, two of whom died in infancy, and a third at the age of twenty years.

Tamson Sophrona Tillson was also born in Massachusetts in 1818. She died unmarried, in Tillsonburg, at the age of twenty years, in 1838.

* Clipped from an unidentified Tillsonburg newspaper, dated March 19, 1892, and reprinted from the Tillsonburg Liberal, December 9th, 1886; found in the Tillson Family Scrap-Book, in the office of the E.D. Tillson Estate, Tillsonburg.

Mary Ann Charlotte Tillson was born in 1822, in Normandale, in Norfolk County, Upper Canada. In 1842, she was married to James E. Turner. She died in Tillsonburg in 1854.

Edwin Delevan Tillson was born in 1825, in Normandale. At the age of fourteen, he "went to sea" on a schooner sailing the Great Lakes; in 1842 he attended school for one year in Norwalk, Ohio. At twenty, he taught school in Dereham Township; and the next year, with the little capital he had managed to accumulate, he set up in business as a lumber dealer. By 1860, his business interests had expanded to include the manufacture of flour, oatmeal, split peas, sash, door, and blinds, and brick. In the words of the Tillsonburg Observer, December 20th, 1866:

"E.D. Tillson's stock comprises everything found in a general store, with the addition of carpenters' and joiners' tools, and an immense stock of lumber of all kinds. His Grist Mill is in constant operation, and supplies flour and feed at moderate prices."

Catharine Merillah Tillson was born in 1827, in Normandale. (In an obituary account of Mrs. Nancy Tillson, the Observer, in 1865, stated that she settled with her husband "in the spot where Tillsonburg now stands, in 1825". If so, she evidently returned to the comparative civilization of Normandale for her confinement.) Catharine died in Tillsonburg, March 8th, 1842, at the age of fourteen years.

Benjamin V. Tillson (on his gravestone called Benjamin Z.) was also born in Normandale, in 1830. He was not yet eleven years old when he died in Tillsonburg in 1841.

Nancy Jane Tillson, the youngest, and the only one of this family to be born in Tillsonburg, was born in 1832. In 1850, at the age of eighteen, she was married to Isaac Watts Barker, presumably a relative of her mother's. To this couple were born six sons, five of them in Tillsonburg, and the sixth a few months after the removal of the family, in 1862, to

the State of Michigan. In May, 1889, she was "Now living near Denver, Colorado".*

"The first store kept in the village was situated on Bloomer Street. The proprietor was Lewis C. Leonard. His dwelling was beneath the store, which was on the second storey, reached by an outside flight of stairs. The building is (1892) yet standing.

"Bloomer Street was the busy street of the village.

"The first tannery was erected by Mr. Scott in 1840, near the present roller mill. Another was erected by E.W. Hyman in 1845-6, on the site of Luke's Brewery.

"The first three frame houses erected were those of Messrs. Levitt, Darrow, and B. Van Norman.

"Mr. Ruggles, to whom Mr. Tillson had made over his saw mill, set to work with great energy to develop the lumber trade, clearing the Otter of jams and obstructions in order to raft lumber to Port Burwell. The saw mill was subsequently run by Messrs. Hingley & Kelso.

"Lumbering formed the staple industry of the place. It kept increasing year by year, and the erection of Mr. Hardy's saw mill near the waterworks reservoir, and a saw mill and grist mill by the late John Smith of Campbelltown, did much to increase the volume of business. Going's grist mill was built by Mr. John Smith, and the number of houses still standing in Campbelltown, on the Smith estate, occupied by the workmen, indicates the large number of men employed in the lumbering business of Messrs. John and Malcolm Smith.

"The plank road between Ingersoll and Port Burwell proved a great boon to the lumbering interests, and the long line of lumber teams was a familiar sight in those days. Large quantities of lumber were teamed to Ingersoll, where it was shipped by rail."†

The Tillsonburg Observer began publication in 1863, and in its first few issues published the prospectus which had heralded the event:

"To the Inhabitants of the Counties of Oxford, Norfolk, and Elgin. On Thursday, 30th July, inst., will be issued the first number of the 'Tillsonburg Observer', for which we respectfully solicit your countenance and support".**

* Genealogical information obtained from "A Chronological History of the ancestry and posterity of Edwin D. Tillson, of Tilsonburg", compiled by E.D. Tillson, printed by the Liberal Print, Broadway (Tillsonburg), May 1889. Edwin Delevan Tillson died in 1902.

† Summarized from the 1892 reprint from the Tilsonburg Liberal, December 9th, 1886 (Tillson Family Scrap-Book).

** Tillsonburg Observer, Aug. 6, 1863.

For the next few years, three great public issues occupied the attention of the people of Tillsonburg: salt, oil, and incorporation. Early in 1864, the Observer began to urge the citizens to seek incorporation as a village; but not until July 24th, 1865, was a public meeting called to give formal consideration to the proposal.

"A Public Meeting of the inhabitants of Tillsonburg, will be held in McLean's Hall, on Monday evening, 24th inst., at 8 o'clock, to consider the propriety of having Tillsonburg erected into a Police Village. A full attendance is requested."*

At the meeting, a resolution to take the necessary steps was carried unanimously; and a month later the petitions were ready for the signatures of the interested inhabitants.

"The petitions to the County Council to erect Tillsonburg into a Police Village, and to have a Lock-up established here, are now lying for signature at Mr. John Thompson's Saddle and Harness Shop. The inhabitants of the Village are requested to call at Mr. Thompson's and sign the petitions".†

In its issue of November 2nd, the Observer reported that the necessary county by-law had been passed, October 13th, 1865. Tillsonburg continued as a police village, without incorporation, until its incorporation as a town, March 2nd, 1872.

Under the heading, "Progress in Tillsonburg", the Observer of February 23rd, 1865, commented on the prospects of Tillsonburg's oil strike.

"There are at present good prospects that the oil territory in the immediate neighborhood of Tillsonburg will be thoroughly developed during the approaching summer. A large quantity of land on the Otter Creek has been purchased conditionally by parties largely engaged in the oil trade, who are desirous of testing the existence of oil in this neighborhood in paying quantities; and we are assured that in one instance at least the purchaser is bound by the terms of his agreement to sink a well 200 feet each year, for a period of three years - or 600 feet in all. This depth will thoroughly test the matter. We are very sanguine of the success of the experiment. The joint stock company's well remains in the state to which it was reduced by the fire at Mr. Tillson's mill (in 1864). However, the flow of oil, though small, is steady,

* Ibid., July 20, 1865.

† Ibid., Aug. 24, 1865.

"and has not decreased since oil was struck some months ago. We suppose operations will be resumed in the spring. Altogether, the prospects of Tillsonburg are brighter than they have been for many a day."

The Observer was whistling to keep his courage up; the happy day when the flow of oil would enrich Tillsonburg never dawned. In the meantime, on January 17th, 1867, the Observer required new and larger headlines: "SALT DISCOVERED AT TILSONBURG!" This display was followed by a lengthy news report of the discovery; and the following week, January 24th, the discovery was the subject of an optimistic editorial. The Tilsonburg Salt Company was organized; the Directors presented their first Report on February 4th, 1868. A strong delegation from the Company visited Goderich, where salt recovery was in full swing, and came back to Tillsonburg recommending "further work on the well in Lot 5, Concession 12, Dereham Township". In the issue of March 19th, 1868, the Observer continued its agitation for the more energetic development of the salt works at Tillsonburg; but the topic ceased to engage the attention and interest of the public. Apparently, salt was as dead as oil; and neither was the basis of Tillsonburg's prosperity.

The principal sources of Tillsonburg's prosperity have always been in industry and commerce, in processing and handling the products of the forests and the farms. Once again to quote the Tillsonburg Observer:

"PROGRESS IN TILLSONBURG. - Mr. E.D. Tillson is making a strong effort to have his whole establishment in complete working order when the spring opens, and with every prospect of success. The planing mill has been running for some time past, and turns out more work than formerly. The muley saw will be working on Monday next (February 27th, 1865); and the circular saws will probably be ready in a short time. When once the machinery is complete and the saws set to work, there is no danger of them soon stopping for want of work, for we learn that Mr. Tillson has now on hand saw logs sufficient to manufacture over four million feet of lumber. We believe it is also Mr. Tillson's intention to re-establish his sash and door factory. Success attend his efforts.

"Mr. Joseph Wardle having leased the Tillsonburg Iron Works, has procured a large number of new and improved patterns, hired skillful workmen, and entered energetically into the manufacture of agricultural

implements of all kinds, stoves, cheese presses, &c., and farmers should give him a fair trial. He also manufactures Crocker's celebrated air pumps for oil wells, and mill gearing and machinery of all kinds.

"Messrs. Harris, woollen manufacturers, from near St. Catharines, have purchased a water-privilege from Mr. M. Burn, for the purpose of erecting thereon a Woollen Factory. A large quantity of the machinery has arrived, and the erection of the buildings will be proceeded with as soon as the weather will permit. The want of such an establishment has long been felt in this section, and its erection will prove a great boon to the farming community. May it prove equally remunerative to the enterprising proprietors."*

And again, in 1867:

"During the last few months our village has exhibited numerous signs of prosperity, in the improvement of the streets, the erection of new buildings. Broadway, from the market square downwards, has been cut down and filled up and side-walks laid, making it now one of the finest streets to be found in any village in Canada. This street has been still further improved by the erection of several fine buildings on vacant lots, and the enlargement and improvement of others. Mr. N.F. Bjork has erected a fine frame store on the corner of the eleventh concession. Mr. Alex Wilson and Mr. Wm. North have put up frame stores on the lot opposite the Oil Exchange Hotel; and last and most important, Messrs. E.D. Tillson and T.B. Bain are erecting a block of three brick stores three stories high and eighty feet deep, equal to any buildings of the kind in the Province. Two of these belong to Mr. Tillson and one to Mr. Bain. One of Mr. Tillson's stores is to be occupied by Mr. J.C. Lindop, and when he goes into it in about six weeks, our readers may expect to see one of the finest stock of goods ever shown in this section. We believe other parties are preparing to build, but it is not likely that any building of importance will be undertaken before next spring."†

Probably the greatest contribution that Mr. E.D. Tillson made to the prosperity of Tillsonburg was the construction of a 500-foot dam across the Otter Creek. By this means he developed more than four hundred horse-power, which, through a succession of races, operated a foundry, a sawmill, a planing mill, and a grist mill. An undated clipping from the Tillsonburg News (about 1950 or 1951) states:

"This dam stood until 1937, when it went out with the spring flood causing heavy property damage.

* Tillsonburg Observer, February 23, 1865.

† Ibid., October 17, 1867.

"Residents tell, however, that it only went out because two other dams above were carried away.

"The network of mills are gone now. After Mr. Tillson's death in 1902 they were sold, and in later years they gradually burned or were abandoned.

"But a solid basis had been laid for future prosperity, and future prosperity was given the community when tobacco growing began in the district. With the growth of the tobacco industry came other industries, such as plants making shoes, farm and garden tools, and all kinds of wood products."*

The name of this town has, from time to time, been variously spelled. From the time of its first being called Tillsonburg, in 1837, this was the spelling used, in conformity with the usual spelling of the founder's name, Tillson. Upon its being erected into a police village in 1865, through a misunderstanding, it was officially recorded as Tilsonburg, with one "l": and the Tillsonburg Observer, at the end of the year 1865, began its new year, 1866, as the Tilsonburg Observer. Despite the discrepancy in the use of the two names, the Tilsonburg Observer continued to make mention of "Tilsonburg" and of "Mr. Tillson". In the meantime, the name of the post office had continued to be "Dereham Post Office"; on March 1st, 1868, the post office name was changed to "Tilsonburg", so spelled: the change was reported in the Tilsonburg Observer of May 21st, 1868.

To add to the existing confusion, the Canada Directory of 1857-58, published by John Lovell in Montreal, used the name Tilsonburgh; and Mitchell's Canada Gazetteer and Business Directory for 1856-65 listed this village as "Dereham, C.W. (Canada West) - Also known as Tilsonburgh". The Historical Atlas of Oxford County, 1876, marked the area representing the community (by this time an incorporated town) as "Tilsonburg", and placed the name of E.D. Tillson (so spelled) on two adjoining farm lots.

On March 17th, 1902, the confusion ended, and by an Act of the Ontario Legislature, the spelling "Tillsonburg" was restored to use, and remains in use ever since.

FIRST MILL			CONTEMPORARY REFERENCE		
TYPE	BUILT	BUILDER	YEAR	OWNER	TYPE
1. S.&G.M.	1807	Earl & Avery	1824	Cromwell & Schooley	S.&G.M.
			1829	Cromwell	S.&G.M.
2. S.&G.M.	c.1816	N. Cook	1822	N. Cook	S.&G.M.
3. G.M.	by 1817	J. Smith	1834	J. Smith	S.&G.M.
4. S.M.	by 1820	J. Throckmorton	1820	J. Throckmorton	S.M.
5. S.M.	by 1820	Wm. Hilliker	1820	Wm. Hilliker	S.M.
6. S.M.	by 1820	S. Lossing	1820	S. Lossing	S.M.
7. G.M.	1825-6	G. Tillson	1827	(no reference)	
8. G.M.	by 1827	J. Birdsall	1827	J. Birdsall	G.M.
9. G.&W.M.	by 1827	Capt. H. Metcalf	1827	Capt. H. Metcalf	G.&W.M.
10. S.M.	by 1831	Birdsall	1831	Birdsall	S.M.
			1839	Moore & Williams	S.&G.M.
11. G.M.	by 1832	J. Moore	1832	J. Moore	G.M.
			1839	J. Moore	S.M.
12. S.M.	by 1845	unknown	1845	Hardy	S.M.
13. S.M.	by 1845	unknown	1845	Francisco	S.M.
14. S.M.	by 1846	unknown	1846	unknown	S.M.
15. S.M.	by 1847	unknown	1847	unknown	S.M.

c. = circa = about



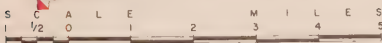
ROADS AND TRAILS - 1820 - 1851

BASED ON CONTEMPORARY "DESCRIPTIONS" AND MAPS

- LEGEND
- Township Boundaries (opened as roads in some cases)
 - - - Surveyed Road Allowances
 - OTHER ROADS
 - - - Roads established by District Quarter Sessions, 1822 - 1829
 - - - Roads established by District Quarter Sessions, 1830 - 1850
 - - - Settlers' Trails in Middleton Township from a map of 1824
 - - - Roads marked as "Travelled" on maps of 1846 - 1851
 - - - Roads marked as "Improved" on maps of 1851
 - - - Connecting roads - Date uncertain

MILLS

Some mills located by Documents before 1850



Vienna

Lots Number 14 and 15 in the Third Concession of the Township of Bayham provided the site of the village that was to be called Vienna. According to the records of the Patent Office of the Department of Lands and Forests, Lot No. 14 was patented, March 30, 1818, to Elisabeth Smith, wife of Jesse Smith, daughter of Peter Fairchild, a United Empire Loyalist; and Lot No. 15 was patented, January 21, 1818, to Samuel Edison. Samuel Edison was the son of John Edison, who, at the end of the American Revolutionary War, had settled at Digby, Nova Scotia; Samuel had been born in New Jersey, and in 1783 accompanied his father to Nova Scotia, where he married, and where, in 1804, his son, also named Samuel, was born. This second Samuel later became the father of the inventor, Thomas Alva Edison. According to an article published in the Tillsonburg News, May 2, 1940, John Edison was persuaded by Colonel Thomas Talbot to leave Nova Scotia and to settle in Upper Canada.

"In 1811, when John Edison settled at the present site of Vienna, three miles north of Port Burwell, he was a man who must have been well on in years considering that he was a grown-up man in 1730 when he came out from Holland. . . . John Edison secured 6,000 acres of land stretching along the Otter Creek from Vienna to Lake Erie and along the lake westward for several miles. . . . On the banks of the Otter at Vienna the Edison home was erected some time between 1816 and 1820, at first of logs and later changed to a frame residence."

Between 1818 and 1834, the two lots, Numbers 14 and 15, the one belonging to Mrs. Smith, the other to Samuel Edison, senior, appear to have come into the possession of Mr. Jesse Smith, who laid out a plot for a village on a part of them, near the banks of the Otter Creek. The transaction involved the opening of streets and the closing of a road, so that it required the approval of the District Court of Quarter Sessions. On June 19th, 1834, Mahlon Burwell, in his capacity of Surveyor of Highways for the London District, submitted the following report and recommendation.

"Certain Freeholders of the Township of Bayham having applied to me Stating that the Road formerly laid out along the Bank of the Big Otter Creek on Lots Numbers Fourteen and Fifteen in the Third Concession of the said Township of Bayham was inconvenient for the uses of the public, and requesting me to Examine the same and report thereon -

"I have therefore in compliance with the said Request Examined the premises and find the Statements of the applicants supported by the fact that the Road in the Southerly and Westerly side of Big Otter Creek on the before mentioned Lots for the greater part of the Way: between the Mills belonging to Jesse Smith, and the Estate of the late Levi Ryan, and the Covered Bridge across the Big Otter Creek at the residence of Samuel Edison Esquire had grown into disuse for a Number of Years past by the common consent of the Inhabitants, Mr. Jesse Smith of Bayham having laid out a Village Plott in parts of the said lots numbers Fourteen and Fifteen and disposed of Small lots to individuals who have Built Houses and made other Erectments on the old route which the Inhabitants had considered useless, by which means no part of the old route to which the applicants refer is in use Excepting where it is intersected by Streets one chain in width, which Mr. Smith has laid out, on the said lots across a Promontory in a Bend of Otter Creek which is named 'Main Street' a few chains below, and then passing down and joining the old Route to the Covered Bridge aforesaid.

"Mr. Jesse Smith having laid out a Village Plot on part of the before mentioned lots adjoining the said Roads or Streets, has proposed to surrender the ground occupied by them to His Majesty and His successors for Ever in lieu of the old Road which has grown into disuse: To this arrangement there appears to be no objections, and he has Executed in my presence, and that of another Witness a Release to His Majesty of the grounds occupied by these Streets as passing through the Village Plot, which is named in the Deed of Release to the Crown under the Style and title of the Village of 'Shrewsberry' - the Deed of Surrender accompanies this Report, which I beg leave to recommend to the approval of your Worships, and that the alterations proposed in this Report be confirmed."

The Historical Atlas of Elgin County, 1877, states that it was Col. Burwell who, in 1830, surveyed part of the Smith farm into village lots; if this is true, then the statement in Burwell's report that Mr. Smith had laid out a Village Plot must be taken to mean that he did so through the agency of the surveyor, and not that he was himself qualified to survey. The Atlas also attributes to Col. Burwell

the wish to name the village Shrewsbury, and adds that "some of the inhabitants caused the name Vienna to be registered and Vienna it is". According to the Atlas, Jesse Smith's mill was located on Teal's Creek, "a small stream near Vienna".

"The development of the stave and lumber trade caused a rapid growth, and in 1850 it was one of the most stirring business places in Western Canada (i.e., Canada West, now Ontario). Its situation favored this - surrounded as it was by forests of pine and oak, with the Otter Creek, navigable to the lake, passing through it, along whose winding banks were excellent facilities for piling and shipping these rich native products of the township. In those palmy days of prosperity the piles of lumber reached from the Fancisco House to the foot of Teale's Hill. There were sixteen general stores all doing a good business, and the usual complement of shops with workers in iron, leather and wood.

"There are two prominent causes for the difference between the past and present: devastating fires and the decay of the lumber trade from the consumption of the timber. In the spring of 1855 or 6, nearly the whole of the business part of the village was swept away, and never wholly rebuilt; and twice during the year 1867 the torch of the incendiary was applied, each time far too successfully.

"At present (1877), the village contains four general stores, four shoe shops, two blacksmith shops, two foundry and machine shops, one tannery, one carding and fulling mill, one woollen factory, one flouring mill, one plaster mill, two steam saw mills, one cabinet factory and planing mill, and two hotels.

"Although not at present progressive in a business point of view, Vienna is yet on many accounts a pleasant place for a home. It is romantically situated in the valley of the Otter, sheltered on three sides by sloping hills and blest with pure water and a healthful atmosphere."*

At least one of the fires mentioned in the foregoing paragraphs occurred, not in 1867, but in December, 1866. It is recorded in the Tillsonburg Observer of December 13th:

"On Sunday morning last (December 9th, 1866) the village of Vienna was again nearly destroyed by fire. The origin of the fire is unknown, but it is supposed to have originated in a room over Mr. Brasher's tailor shop, occupied by one of the workmen named Robert McKay, who was burned in the building, and whose bones were found after the

* Historical Atlas of Elgin County, 1877.

"fire. The flames next seized upon Mr. Suffel's barn and store, then Price's tavern, and crossed the street to Mr. Jewell's store. The Post Office, Telegraph Office, and one or two more small buildings were destroyed. Lambert's San Francisco House was several times on fire, but by great exertions on the part of the inhabitants was saved. Mr. Jewell's whole stock, books, &c., were lost; the building and its contents being burned before the doors could be opened, insured for only \$1,800. Mr. Suffel was so fortunate as to get out most of his dry goods, but his loss will still be very heavy. We have not heard whether the other sufferers saved anything or not, or were insured. This fire, occurring so shortly after the former equally disastrous conflagration, will prove a heavy blow to the business of Vienna for a time."*

Three months later, rebuilding operations were under way, and the Vienna correspondent of the Tillsonburg Observer wrote in an optimistic vein:

"This unfortunate town is again rising like a phoenix from its ashes, and in a short time will doubtless present as busy and bustling an appearance as ever. Messrs. Suffel & Co. have erected a fine brick store, and are preparing to lay in a very heavy stock of spring and summer goods, clothing, &c. L.J. Gundry, druggist, has rebuilt his store larger than formerly, and better stocked. Mr. H.B. McAllister has rebuilt his grocery nearly opposite Mr. Gundry's. Mr. T.T. Brown has not yet rebuilt, but has removed his large stock of dry goods, groceries, &c., into a store south of Patton & Co.'s. All are making preparations for the spring campaign, and will doubtless do a good business."†

Whether because of the "heavy blow" or for other reasons, the village never resumed its "busy and bustling appearance". It is probable that the "decay of the lumber trade" had most to do with the decline of Vienna as a business centre. The population returns tell a significant part of the story.

* Tillsonburg Observer, December 13th, 1866. The issue of December 20th, 1866, contained an eye-witness' description of the fire, and supplied many further details.

† Tillsonburg Observer, March 21, 1867.

Population of Vienna, 1851-1951

1851	800*
1857	1100†
1864	900**
1871	593††
1881	528
1891	398
1901	352
1911	332
1921	288
1931	217
1941	260
1951	322

Vienna became an incorporated village, January 1st, 1853.

Norwich

First known as Norwichville, this village grew up as the centre of the social and economic life of the northern half of the original Norwich Township, later to become Norwich North Township. Settlement of the township began with the purchase of 15,000 acres by Peter Lossing and his associates, in 1810. An account of the beginnings of the village is contained in the Norwich Old Home Week Booklet, 1946:

"The village began when the first store was opened in 1828 by William Barker on the south side of Main Street near the main corner. This was on property marked on the 1820 map as belonging to Adam Stover. The development for some years was largely on the north side of what is now Main Street, on Michael Stover's property. Michael Stover's own house was on what is now Clyde Street, near the bandshell. The last of his apple trees was cut down a few years ago on Miss Lees' lot. His son, Michael, Jr., lived north of the high school building. A great many of his trees were made into sleighs and wagons by James Wickham, who began business in Norwich in 1842. The fact that the Michael Stovers had a thousand acres which they could not possibly clear and work themselves led them to encourage buyers who wished small lots to form a village. In the early thirties, a young man, John McKee, came to Norwich and started a tannery. He married Paulina Stover, Michael's

* Lovell's Canada Directory, 1851.

† Lovell's Canada Directory, 1857-1858.

** Mitchell's Canada Gazetteer, 1864-1865.

†† This, and the following figures, are taken from the Census Reports of Canada.

"daughter, the first white girl born in the township. . . . The tannery was on a little spring creek which ran through the east front of (McKee's) lot . . . They built a pretentious home which was for many years the finest in the village."

"At first the Society of Friends were more numerous than any other group; they had settled on Quaker Street, a mile north of the village. The first place of worship was built there; the first school was on the banks of the Otter near there; and the first post office was in Peter Lossing's house in 1830. . . . The pioneer burying ground was on Peter Lossing's and John Tompkins' land just west of the post office."

"The farmers of Norwich were equipped to do a lot of their own manufacturing. They probably took their hides to the McKee tannery, but they could and did make shoes and mend them themselves. They also made furniture, cupboards, tables, and splint-bottomed chairs. Moses Mott made the desk that he used so long as clerk and treasurer of the township, and it is still in good condition. The floor of his office in his home was of two-inch oak boards to stand the inevitable wear and tear of a public place."

"In the home the women folk spun and wove flax for linen, prepared wool, spun it and wove it, and were experts at dyeing. Maple sugar, their own meat products, plenty of vegetables and fruit, made them independent of the grocer and butcher, except for spices. Mills were established early for flour. They made candles for lighting, lamps being a modern innovation."

"Much trade was carried on by bartering. Michael Stover, Jr., sold ash and oak and maple logs for a wagon and a cutter. His father traded apples for repairs on his wagon. Mr. Kingsford brought a quarter of beef and a sheep for a new wagon with a spring seat. William Mason bartered pickled cucumbers and a plastering job for his wagon. John Siples traded three cheeses (34 pounds in all) with ham and hay, for axle trees, a coulter, etc. David DeLong exchanged two ash trees, a veal, and some wheat for repairs on a threshing machine. George Summers brought 'mush melons', and Mr. Van Valkenburg did carpenter work for his sleigh."

In 1846, Wm. H. Smith's "Canadian Gazetteer" reported the village of Norwichville to contain about 180 inhabitants: "pleasantly situated on Otter Creek . . . post three times a week", and summarized the professions and trades:

"One physician and surgeon, one grist mill, carding machine and fulling mill, one distillery, one tannery, four stores, two taverns, one chair maker, one waggon maker, one blacksmith, one tailor, one shoemaker."

The same writer, in his "Canada: Past, Present and Future" (1851) gives a more detailed account:

"About two miles before you reach Norwichville (from Scotland), the road is again bordered with splendid farms. Norwichville, which is pleasantly situated in a rolling country, is a considerable village, with the Otter Creek flowing a little below it. It contains about four hundred inhabitants; two churches, Presbyterian and Methodist. An Episcopal church was nearly completed when it was destroyed by fire. There are also in the village a grist and saw mill, two asheries, carding machine and fulling mill, tannery, and a foundry, the ore for which is obtained from Long Point."

Lovell's Canada Directory, 1851, supplies the following additional information.

"NORWICHVILLE - A Village situated in the Township of Norwich, County of Oxford, C.W. - distant from Toronto 95 miles, from Woodstock 17 miles - usual stage fare to Burford, 2s. 6d. Population about 450.

"WHITNEY, B.S. & E., tin and coppersmiths, keep constantly on hand a good assortment of every article in their line of business, at very moderate prices.

"Addison, William	cabinetmaker
"Anderson, Edward	shoemaker
"Avery, O.	inspector of licenses
"Bailey, J.	harnessmaker
"Barr & Co.	iron foundry
"Beard, Dr. J.L.	physician and surgeon
"Bedford, Paul	innkeeper
"Bleakley, George	cabinetmaker
"Brown, R.	innkeeper
"Carnaby, J.H.	attorney at law, clerk of division court, and agent for National Loan Fund Life, and Equitable Fire Assurance Companies
"Chapman, Rev. J.F.	Methodist
"Cook, E.L.	agent for marriage licenses
"Cook, Dr. E.	physician and surgeon
"Cornell, H.J.	general store
"Halligan, J.	tailor
"Hand, T.	bootmaker
"Hand, W.	bootmaker
"Murphy, S.	tailor
"Moore & Sutton	general store
"Morley, G.W.	bootmaker
"Polden, William	bootmaker
"Scott, Robert	saleratus factory
"Steel, John	merchant and miller
"Smith, S.	general store
"Stroud, W.	innkeeper
"Thompson & Yates	tailors
"Wallace, Thomas	postmaster, merchant and distiller
"Webster, David	general store
"Wickham, James	carriagemaker."

In 1857, when the next "Canada Directory" was published, the name of the post office was given as Norwich,

although the village still went by the name of Norwichville. A number of changes had taken place. James Barr was now the sole proprietor of the foundry and machine shop; P. Bedford was "innkeeper and reeve"; Buck & Bailey operated the grist mill; Dr. Cook was "M.P.P."; Rev. P. German was Wesleyan minister, while the Rev. T. Webster represented the Episcopal Methodist body; the Rev. M. Keleher was the Roman Catholic priest; William Hand and John McCulloch were listed as tanners; the village now had a watchmaker, G. Sutton, and a jeweller, William Lewis; William West was a waggonmaker; and Gilbert Moore was postmaster. The population had increased to 700.

After the lapse of another seven years, appeared Mitchell's "Canada Gazetteer and Business Directory, for 1864-65", in which the village received the following notice.

"NORWICH, C.W. - A post village in the township of North Norwich, county of Oxford, South Riding, and settled in 1816. Trade, local. Distant from Woodstock, the county town, 16 miles; from London, 40 miles; and from Hamilton, 50 miles. Population 750.

"Adams, H.J.	saddle and harness maker
"Anderson, Edward	boot and shoemaker
"Addison, Wm.	cabinet maker
"Avey, Charles	brickmaker
"Barr, James, J.P.	notary public, and clerk division court
"Barr & Co.	founders, machinists, manufacturers of agricultural implements
"Beard, George L.	physician and surgeon
"Bleakely, G.	baker and confectioner
"Bradley, Miss Agnes	dressmaker
"Brown, Robert N.	cooper and stavemaker
"Bungary, L.F.	copper smith
"Caffon, Henry	dealer in china, glass, &c.
"Cameron, Duncan	builder
"Carroll, James	physician and surgeon
"Carroll, Wm., J.P.	
"Carter, Joseph	blacksmith
"Carter, Samuel	carriage and waggon maker
"Carolan, Thomas	blacksmith
"Catton, Henry	grocer
"Clifford, Charles	cabinetmaker
"Coker, Wm.	hotel keeper
"Cook, E..	surgeon
"Crane, R.S.	carpenter
"Donald, Rev. W.	
"Douglas, John	tanner, dealer in hides and leather
"Elgin House	A. Moore, proprietor

*Trinity Church (Anglican), Port
Burwell 1836. The church and
glebe were donated by Colonel
Mahlon Burwell, D.P.S., founder
of the village.*



*Beechcroft, Port Burwell, built in the 1840's by Leonidas Burwell on the estate given him by his
father, Mahlon Burwell. The house had a light veranda on at least two sides. The present porch
columns, brought from an old house in Detroit, may be some years older than this building.*

"Foster, Morgan & Co.	general store
"Gentle, Walter	brickmaker
"George, Wm.	tailor
"Green & McCausland	general store
"Haken & Wood	boot and shoemakers
"Hall, Charles	carpenter and builder
"Hand, Wm.	boot and shoemaker and tanner
"Huntingdon, G.	iron founder and machinist
"Jennings, S.	collecting agent
"Kinney, Daniel	chair manufacturer
"Lewis, Wm.	photographic artist
"McAulay & Campbell	blacksmiths
"McClellan, Wm.	general merchant
"McKee, John, J.P.	
"Miller & Co.	general merchants
"Montross, J.	carriage and waggon maker
"Murray, C.	photographic artist
"O'Neil, J.	hotel keeper
"Palmer, H.	dentist
"Parsons, Henry	clothier and merchant tailor
"Peake, Rev. E.	
"Pitcher, T.	grocer
"Polden, Wm.	edge tool manufacturer and black-smith
"Potneff, A.	millwright
"Roddy, David	tailor
"Sackrider, Charles	general store
"Sackrider, Mrs. L.	bonnet maker
"Scriven, P.	engraver
"Snider, Rev. S.	
"Stevenson, H.	sash, blind and door manufacturer
"Sutton, G.C.	acting postmaster (watches, jewellery, &c)
"Swartout, L.	carpenter
"Swift & Brothers	flour and grist mills
"Switzer, Amos	chair manufacturer
"Tidey, John A.	druggist
"Van Valkenburg, H.	J.P.
"Van Valkenburg, T.	carpenter
"Vestal, John A.	dentist
"Wallace, Thomas	J.P., insurance agent and notary public
"Walker, George	cabinet maker
"Willson, S.	carriage and waggon maker
"Yates, John T.	tailor."

Norwich became an incorporated village on January 1st, 1876.

Port Burwell

The present village of Port Burwell stands on Lots 10, 11, 12, and 13, in the first Concession of the Township of Bayham. Lots 10 and 11 had been granted to Colonel Mahlon Burwell, February 5th, 1811; but the Patent had inadvertently "omitted to reserve to the Crown the waters of the Big Otter Creek", and, on September 4th, 1812, a new Patent was issued in which this oversight was corrected. Colonel Burwell was impressed with the possibilities of navigation on the Otter Creek, and recommended the formation of a harbour

at the mouth of the creek and of a village on the adjacent banks. In a letter to the Surveyor-General, he outlined the plan.

"Townsend, 20th June 1815

"Thomas Ridout Esquire
"Surveyor General
"&c &c &c
"York

"Sir,

"Otter Creek discharges more Water than all the small Rivers which disembugue themselves into the North side of Lake Erie, excepting the Grand River. When a few drifts are cleared out of it, Boats may descend from the Mills in Norwich to its Mouth, at almost any Season of the Year.

"There are beautiful Groves of White Pine Timber, on each side of the Creek, interspersed with Groves of other Timber, alternately; there is therefore no doubt, but that ere long considerable quantities of Timber will be conveyed down that stream, from Norwich & other places to the Lake.

"It would appear as if Nature had intended the Mouth of Big Otter Creek for a place of greater importance than any other in the District of London. In my mind it is highly probable that such will be the case before many Years.

"I am about to lay out what Lands I own on the East side of the Mouth in a Town Plot.

"If my recollection serves me correctly, Lot No. 12 first Con'n Bayham, which lies along side of the Land I am going to Survey for a Town, is a reserve; And I beg leave to suggest, that, if it should meet with the approbation of His Excellency the Provisional Lieutenant Governor, it would much facilitate the future growth of that part of the Province, to have it laid out by the Government, for a Town at the Mouth of Big Otter Creek."*

Burwell's estimate of the future of navigation on the Otter proved to be unduly optimistic; but his vision of a village and harbour at the mouth of the creek has since been more than realized. The manner of the proposed development was not, however, entirely as he conceived it.

It was true that Lot 12 was a Clergy Reserve lot. Burwell himself, in 1818, leased it from the Government;

* Survey Records, Department of Lands and Forests. Surveyors' Letters, Volume 13, No. 40.

and ultimately, March 17th, 1834, he purchased it, and laid it out in village lots as part of the Town Plot he had proposed to survey.

Part of Port Burwell lies in the south-west quarter of Lot 13, in the same first Concession of Bayham. This lot had been granted in 1812 to the Honourable John Hale. Later, when the Executive Council recognized Colonel Talbot's right to assign locations in Bayham Township, this lot was one of several that John Hale surrendered in exchange for lands to be granted elsewhere; and in 1823, Lot 13 was patented to Hannah Backhouse, "wife of William Backhouse, and daughter of the late Edward McMichael, deceased, U.E.L." On the plan of Port Burwell that is contained in the Historical Atlas of 1877, two of the streets in this part of the village are named "William" and "Hannah".

It took fifteen years to get Burwell's proposals translated into realities. The development of the harbour proved to be a task beyond the powers of local enterprise, and application was made to the Government of the province for assistance, as the following minute indicates, taken from the Journal of Assembly, January 16th, 1829:

"Mr. John Rolph, seconded by Mr. Dickson, moves, that a select committee be appointed to enquire into the practicability and expediency of constructing a harbour at the mouth of Otter Creek, in the London District, and of improving the navigation of that stream from its mouth, and as far as navigable towards its source, and to report the most practicable and economical method of providing the means for accomplishing those objects and for the gradual repayment of any sums raised therefor; and that Messrs. Matthews, Horner, Malcolm and McCall, be that committee with power to send for persons and papers, and report thereon by bill, or otherwise, Which was ordered."*

Five years later, February 18th, 1834, a committee of the Assembly, under the chairmanship of Col. Mahlon Burwell, submitted a report on "Harbours on the North Shore of Lake Erie". The report contained a brief reference to Port Burwell.

* Journal of Assembly of Upper Canada, 1829: page 13.

"The harbour now forming at Port Burwell, by means of a Joint Stock Company, will, when completed, be one of the best on the lake, and of great importance to the commerce of the country, on account of the great quantities of pine lumber which are annually exported from that place, and for the continuation of which, for a long time to come, the banks of Big Otter Creek and the neighbouring country affords almost an inexhaustible source of material. The completion of this harbour, however, cannot be expected so soon as is desirable, without assistance from the Legislature, on account of the scanty means in the power of the Joint Stock Company."*

The problems involved in the business of harbour development - costs, construction, maintenance, capacity, volume of traffic, exposure to storm damage - these things were to plague the good citizens of Port Burwell for many years to come.

In the meantime, the harbour, such as it was, had come to handle a considerable volume of both imports and exports. John Burwell, a brother of Colonel Mahlon Burwell, was appointed Collector of Customs. He reported, early in 1835, that the imports at the Port of Port Burwell for the year 1834 amounted to a total of £475-13-3, of which the largest item, making up nearly half of the total, was Leather. He was unable, in the absence of clearance records, to state the exact value of the exports, but estimated them at not less than £5,000, consisting chiefly of lumber, spars, masts, shingles, and shingle bolts.†

Toward the end of the year 1836, the Port Burwell Harbor Company made a new application to the Government for assistance in meeting the costs of construction and repair required by their harbour. Their petition has not been found, but the report of the Select Committee is preserved in the Journals of the Legislative Assembly. It is here reproduced in full.

* Journal of Assembly of Upper Canada, 1833-34: Appendix, page 109.

† Journal of Assembly of Upper Canada, 1835: Appendix, Vol. I, No. XI, pages 13-14.

"Mr. Chisholm, of Halton, from the Select Committee, to which was referred the petition of the President of the Port Burwell Harbor Company, presented a Report, which was received and read as follows: -

"To the Honorable the Commons House of Assembly.

"The Committee, to whom was referred the petition of the president of the Port Burwell Harbor Company, beg leave to report: -

"That they agree in the view taken by the petitioner, on the subject of Harbours being the property of the public, and have to express a hope, that the time is not very distant, when the means for their construction and repairs, shall be provided for, at the public expense; - and that they shall be generally relieved from the embarrassments which the trade of the Province is subject to, by the collection of tolls and dues, from the individuals who happen to use the Harbours; but until some general arrangement on this subject shall be made by the Legislature, the present mode, must, of necessity be pursued.

"Your Committee find, that the Incorporated Company, have constructed a Harbour at Port Burwell, from which the Schooners and Steamers of Lake Erie, and many Schooners from Lake Ontario, that have passed through the Welland Canal, have for two years past, particularly in the year just expired, received great accommodation, hitherto entirely free from charge, by which the trade of the Province has been increased, and that this service has been performed without any advance of assistance from the public revenue.

"That the injury which the said Harbour has sustained, from the severity of the gales within the last two months, by the loss of two Cribs, equal to 90 feet of the outer end of the Eastern Pier, ought to be repaired, and the Piers extended as speedily as possible. And from the present state of the trade of that place, your Committee are satisfied, that if the sum of three thousand pounds, was granted to the Company, by way of loan, on the credit of the Province, it would be no charge on the public revenue, because the interest on the sum loaned, would be regularly paid, and this would be made quite certain, if as the petitioner has proposed, the Act granting the money shall provide that the Company, who have already expended large sums of money in the construction of the Piers and Harbour, from their own private means, shall derive no benefit from the tolls and dues to be collected at the said Harbour, but such as may accrue over and above paying the annual interest of the money loaned. Take for instance, two items of the exports of last year, viz.:-

4 Millions of feet of Boards,	
at 1s. 3d. per th	£250 0 0
2,000 Cords of Shingle Bolts,	
at 5s. per cord	500 0 0
	<hr/>
	£750 0 0
Deduct the interest of	
3,000 loaned	180 0 0
	<hr/>
The Company would have a balance	
of	£570 0 0
to apply to their own uses.	

"In this view of the subject, which your Committee believe to be correct, they have adopted a resolution, which they report herewith, and beg leave to recommend it to the adoption of the House.

"All which is respectfully submitted.

"WILLIAM CHISHOLM,
"Chairman.

"Committee Room, 9th January, 1837.

"Resolved - That there be granted to His Majesty the sum of three thousand pounds, to enable His Majesty to grant the said sum to the Port Burwell Harbour Company, by way of loan, securing to the Province the payment of the annual interest thereon, from the tolls and dues, to be collected at the said Harbour."*

The survey of the Town Plot was not completed until the year 1830. The Port Burwell Centennial Souvenir Book, 1930, gives an account of the infant community.

"In 1830, at the time of the survey, there were but two houses in the Port, one occupied by Mr. Foster and the other by the Customs Officer, Mr. Draper. In 1832 a tavern was built by Mr. Hollowood, and soon afterward Col. Burwell, who proved to the last a staunch friend and patron of the Port, organized a Harbour Company and built an Episcopal church, which he endowed with six hundred acres of land. In 1833 only a few homes had been built and the village boasted of but three cleared streets. In 1836 the village numbered about 200 inhabitants."

Prosperity and progress in the village depended to a large extent on the development and maintenance of the harbour; and the harbour was the subject of much debate, numerous investigations, and several optimistic recommendations, but little action. In 1839, Lieutenant-Governor Sir George Arthur had to regret that "there is not at this moment, through the long line of coast from the Grand River to Amherstburg, one Port capable of affording secure shelter to our steamers and sailing-vessels from those violent storms which are of such frequent occurrence on that Lake". He referred to the importance of harbours in developing the commercial and agricultural interests of the Province, and hinted at "other circumstances connected with this subject too

* Journal of Assembly of Upper Canada, 1836-37: page 250.

obvious to require explanation, which cannot fail to procure for it the serious attention of the House of Assembly". It was only a few months since an invasion of Canada had been attempted near Prescott, on the St. Lawrence River; political and military expediency was in the minds of all to whom the Governor's message was addressed.

"Port Burwell (in 1841) is a beautiful little village, 7 miles from the Talbot Road, built at the outlet of Big Otter Creek, on the shore of Lake Erie. It has a fine harbour, several stores, a good tavern, many manufactories, and an elegant Episcopal Church recently built; there are large mills at Vienna, two miles above it, on the Creek, carrying on a very extensive business. It has a bye post from Bayham on Otter Creek, from which it is distant about 8 miles."*

If the sum of three thousand pounds, appropriated in 1837, was actually spent on improving the harbour, its effects were short-lived.

". . . at Port Burwell the entrance is blocked up, the old piers are so placed as not to be available, and in fact all that has hitherto been expended is so much lost.

"Port Burwell is the most exposed part on the lake, for it has to withstand the South-west winds for a sweep of 180 miles. The state of the works erected here by the Port Burwell Harbour Company, bears ample testimony to the forces in operation. I would not therefore recommend expending a farthing upon this harbour, unless the sum appropriated is sufficient to construct the work in the most substantial manner, and a less sum than £20,000 would not, in my opinion, be adequate to it.

"The establishment of a Harbour here most unquestionably would be of very great importance to the section of country adjoining it, which is well settled, improved and productive, and the amendment of the road leading to it would proportionably confer a boon on that part of the country."†

While the engineers of the Board of Works were estimating, investigating, and often discouraging, there was heard from time to time the voice of the enthusiast, who was employed, officially or unofficially, in making Canada West

* Rolph, Thomas. A descriptive and statistical account of Canada. London, 1841. Page 240.

† Report, December, 1844, of the Board of Works. Journal of the Legislative Assembly of the Province of Canada, 1844-45: Appendix AA.

attractive to emigrants from the British Isles. Even such a one could not always paint an entirely happy picture.

"Of the timber grown (in Bayham Township) there are large quantities of pine, but also maple, ash, black walnut, different kinds of oak, chestnut, and cherry. The fine streams of the Little and Great Otter run through Bayham, and the agreeably situated village of Port Burwell is placed at the mouth of the latter, upon the high banks of the lake. The situation of Port Burwell is allowed to be much more pleasant for a town than any other place on Lake Erie; and from the fullness of the stream, a finer harbour, it is believed, could be formed than even at Port Stanley. But it is said that a short-sighted, illiberal policy with the proprietors of the land at Port Burwell and its vicinity has hindered the growth of the locality; the indifferent quality of much of the land would no doubt too greatly operate. A large trade in pine timber, sawn into boards, is capable of being carried on here, for the supply of the opposite State of Ohio, about 60 or 70 miles across the lake."*

The condition of the harbour was still unsatisfactory, and still the subject of debate and investigation, when, May 4th, 1847, C.S. Gzowski, a Polish engineer in the employ of the Commissioners of Public Works, submitted his report.

"The works constructed at this Harbour, by a Company, have been surrendered to the Government; but nothing has been done to improve them, and they are, at present, in so dilapidated a state, that the Harbour cannot be used, except by the smallest description of vessels, and then only during the favorable weather.

"All the shipping of lumber, which is very extensive (the country, in the rear, abounding in the very best description of pine), is done by scowing it out to the vessels, and consequently, cannot be performed, except in fine weather.

"The natural position, though as favorable as that of any other Harbor, on the shores of Lake Erie, dependent upon an inland stream, is very much exposed; it has to withstand the south-west winds, for a sweep of 180 miles, and requires that the works constructed should be of a very firm and permanent description.

"The stream is deep and navigable for a considerable distance.

"From the large tract of country, to which the Harbor is the natural outlet, and from the extent of business done, even now, in its present dilapidated,

* Brown, James Bryce, Views of Canada and the Colonists. Edinburgh, 1844. Page 81.

"and I may say, unapproachable state, there is every reason to believe, that if the improvements were made in a permanent manner, and giving that accommodation and facility to shipping, which it requires, a large revenue would be collected at the Harbor.

"From the examination made of this place last fall and spring, I beg leave to submit the following estimate, for its construction:-

"To construct the Piers 30 feet wide to water 14 feet deep	£15,080	12	6
"To improve the present Inner Piers	550	0	0
"To construct a Pier Light	250	0	0
"To construct a Basin & Turning Place, for vessels	<u>1,615</u>	<u>0</u>	<u>0</u>
"Total estimate of cost of work to be constructed at Port Burwell .	£17,495	12	6"

A year later, "nothing having been done at this place by the Department, the Commissioners only refer to it with a view of recommending the importance of its construction whenever the circumstances of the Province will permit". Still another year passed, and once more the Commissioners of Public Works present a disheartening picture of the scene at Port Burwell.

"At Port Burwell I examined the condition of the Harbour, and the remains of the works, which appear to be completely in ruins. The mouth of the harbour is obstructed by deposits of sand made by the waves, and which are daily accumulating.

"Vessels having cargoes to ship or deposit, are compelled to remain at a distance, until their object can be effected by means of the small boats, which draw but very little water; this process is both tedious and expensive. The construction of a suitable harbour at this place would be very expensive. . . .

"I was informed at Port Burwell, that a Company was in course of formation to raise, by means of shares or stock, a sum sufficient for the construction of a suitable harbour. This Company intends applying to the Legislature for a Charter to enable them to establish rates, and receive tolls, as soon as the harbour is finished and thrown open. In this case, with proper conditions, there does not appear to me to be any obstacle to prevent the realization of a

* Journal of Legislative Assembly of the Province of Canada, 1847: Appendix QQ (Appendix Letter F).

"project so useful in its nature, and of such general interest to the whole neighbourhood."*

All these difficulties, frustrations, and delays could not change the fact that there was a vast amount of traffic, of lumber, grain, and other produce, originating in and near the Township of Bayham, demanding to be transported. Indeed, it was just that demand that, in the face of economic, and some suspected political, handicaps, kept alive the agitation for a harbour at "the Port". "The Otter Creek proved the only source of outlet from the heavily timbered district, and Port Burwell the shipping point. From two to four hundred vessel loads were shipped annually through this port Following the timber period a new industry, that of ship-building, was opened at the Port, and a large number of vessels of various sizes were built here."†

The Tillsonburg Observer, March 21, 1867, offers a pleasant and promising picture of prosperity in Port Burwell.

"Port Burwell appears to be a thriving place, if we may judge from the stir in the streets and the numerous customers in the stores, when we visited the place the other day. Messrs. Youell & Co., and Messrs. Wildern & Ault seem to be doing a prosperous business in the general line, and Mr. W.A. McCollom's drug business would do no discredit to more pretentious places. The shipping interests are very brisk also, preparing for the opening of navigation."

Port Burwell was erected into a police village in June, 1900; and became an incorporated village, January 1, 1949.

Bayham Post Office (Richmond)

The beginnings of the community known to the Post Office Department as Bayham P.O., and generally called Richmond by the people of Bayham Township, were located on part of Lot No. 111 on the South side of Talbot Road, which

* Journal of Legislative Assembly, Province of Canada, 1849: Appendix BB (Appendix C).

† Port Burwell Centennial Souvenir Book, 1930.

is the third lot in the township, numbering eastward from the boundary between the Townships of Malahide and Bayham. The Atlas of 1877 shows part of the village occupying the south end of the corresponding lot on the North side of the Road. The following information regarding a few of the lots in this vicinity is taken from the Domesday Records, in the Ontario Department of Lands and Forests; it should be borne in mind that the dates of Patent are generally from three to ten years later than the dates of location: it took the settler such an interval of time to complete his settlement duties and to become entitled to receive his Patent.

<u>Lot</u>	<u>Name</u>	<u>Date of Patent</u>
109 South side	Solomon Moore Jun'r son of Solomon Moore of Louth Township, U.E.L.	February 4, 1823
109 North side	David Pound son of Daniel Pound, of Bertie Township, U.E.L.	May 20, 1822
110 South side	Edward DeField of Stamford Township, carpenter, a Settler located by Col. Talbot	September 15, 1835
110 North side	William Moore Settler located by Col. Talbot	April 15, 1848
111 South side	Caleb Cook Settler located by Col. Talbot	September 1, 1826
111 North side	Elijah McKenny son of Amos McKenny, of Niagara Township, deceased, U.E.L.	July 4, 1820
112 South side	Thomas Godwin	March 14, 1821
112 North side	James Gibbons	February 17, 1820
113 South side	Andrew Anderson son of Peter Anderson, U.E.L.	May 25, 1836
113 North side	Elizabeth DeField wife of Joseph DeField, daughter of Peter Anderson, U.E.L.	February 17, 1820

<u>Lot</u>	<u>Name</u>	<u>Date of Patent</u>
114 South side	John Killmaster Settler located by Col. Talbot	February 27, 1819
114 North side	Edmond King Settler located by Col. Talbot	March 26, 1823

Of the twelve settlers whose names are listed above, five were sons (or the daughter) of Loyalists, five were located by Colonel Talbot, and two are listed without the nature of their claims being indicated. Caleb Cook, who occupied Lot No. 111, South side, was one of Talbot's settlers.

According to one account, Caleb Cook was a veteran of the War of 1812, and had fought at the Battle of Queenston Heights. He came to Bayham Township in 1816, and built himself a log cabin on the lot that was to be his home. In due course, he brought his wife and two children to his wilderness home, travelling "over the steep Otter hills on one horse. The effort killed the horse, but the Caleb family survived to establish a home."*

But the beginnings of Richmond go back a little further than the date of Caleb Cook's arrival.

"The real settlement of Richmond began in 1811 when James Gibbons and Joseph DeFields built log huts in the dense pine forests between the two Otter Creeks. Mr. Gibbons selected a spot near the bridge north of the Talbot road, then only a blazed trail through the woods. Mr. DeFields was the district's first magistrate, serving in this capacity from 1818 to 1832. The name 'Richmond' was derived from the Duke of Richmond, a close personal friend of Col. Talbot. . . . Despite the fact that postal authorities, because of duplication, use the name 'Bayham', the Richmond title still persists."

"By the year 1837, the first business establishments, a tannery and general store built in 1819, had been increased by the addition of two stores, a second tannery, and two hotels."*

John Lovell's "Canada Directory" of 1851 described Richmond as "a Village situated in the Township of

* "Village of Richmond West in Bayham Township": a clipping from the St. Thomas Times-Journal, 1949 (the exact date not given).

Bayham, County of Middlesex (as it was then), C.W. - distant from Aylmer 7 miles, from London 37 miles, from Hamilton 68 miles, usual stage fare to St. Thomas, 3s. 9d., to Burford, 6s. 3d., to Norwichville, 3s. 9d. Population about 250". The business and professional list follows:

"COOK, SETH, hotelkeeper, Talbot Street - travellers will find this a comfortable and convenient house, and charges reasonable.

"COOK, SYLVESTER, general merchant and dealer in dry goods, groceries, hardware, crockery, &c., Talbot St.

"LIVINGSTON, JOHN, commissioner in bankruptcy, &c., Talbot St.

"Anderson, John	waggonmaker
"Birdsall, Jacob	saw mill
"Burghar, John P.	saw mill
"Cook & Spitter	waggonmakers
"Dancy, Dr.	physician and surgeon
"Day, Captain	innkeeper
"Goodwin & Spare	general merchants, tanners and curriers
"Hughes, Mr.	schoolteacher
"Hewet, N.	founder and machinist
"Leach, Jacob	inspector of licences
"Lockhead, Rev. M.	Wesleyan
"Marsh, Rev. Mr.	Baptist
"Millard, John	blacksmith
"Maguire, Thomas	shoemaker
"Mastin, G. & R.	cabinetmakers
"Miro, Anthony	blacksmith
"Moore, J. & Sons	grist and saw mills
"Moore, John	clothing and turning works
"Pauling, Adam	tailor
"Phillimore, William	saw mill
"Reed, Rev. Mr.	Church of England
"Springall, Thomas	postmaster and tailor
"Titus, D.	innkeeper
"Wheaton, Orson	millwright
"Wilson, A.M.	sawmilling and township reeve
"Woods, James H.	cabinetmaker
"Williams, Dr.	physician and surgeon"

In the 1857 "Canada Directory", there were a few notable changes: Charles Ault, was physician and surgeon; Seth Cook was listed as a lumber merchant, while Patrick Doyle had taken over his hotel ("good accommodation for the travelling public"); William Moore had a grist mill; William Perkins was proprietor of a Temperance Saloon; Richard Simmonds was the proprietor of grist and saw mills; J.H. Woods was an undertaker. The population was about 500.

The next directory in which this village was noted was Mitchell's "Canada Gazetteer and Business Directory for 1864-65".

"Bayham, C.W., or Richmond Village, in the township of Bayham, and county of Elgin, East Riding, situated on the Otter Creek, which empties into Lake Erie at Port Burwell. Bayham has a good common school. Distant from Port Burwell 11 miles, St. Thomas, the county town, 20 miles, London 36 miles, Ingersoll, 20 miles. Daily Mail. Population 300.

"Ault, Chas. & Jas.	physicians and surgeons
"Birdsall, Jacob	saw mill proprietor
"Blanchfill, J.	shingle maker
"Burbridge, Edward	carriage and waggon maker
"Cook's Hotel	Sylvester Cook, proprietor
"Davis, E.	blacksmith and brickmaker
"Garrett, Benjamin	blacksmith
"Hamilton, John	shoemaker
"Hendershot, Plumer	flour and grist mill owner
"High, Thomas	tanner
"Laing, George	general merchant
"Laing, Walter	general merchant
"Mann, P.M.	physician and surgeon
"McKenny, Albert	hotel keeper
"Mero, Anthony	blacksmith
"Moore, Andrew	J.P.
"Moore, Jeremiah	carpenter and builder
"Morse, Wm. D.	cabinetmaker
"Murray, Wm.	shoemaker
"Nesfall, H.	shingle maker
"Pauling, Adam	merchant tailor
"Phillimon, W.	saw mill owner
"Reid, Rev. Henry	Wesleyan Methodist
"Scriver, Henry	carpenter and builder
"Simmonds, Richard	flour and grist mill proprietor
"Spitter, David	carriage and waggon maker
"Spore, L.W.	shoemaker
"Springall, Thos.	postmaster and tailor
"Stoneman, Wm.	carpenter and builder
"Veitch, R.W.	scourer and dyer
"Veitch, R.W.	saw mill owner
"Wallace, John	carriage and waggon maker
"Warburton, George H.	conveyancer, commissioner for taking affidavits, and general merchant
"Woods, James H.	cabinetmaker"

Willsonburg

About a mile north of the village of Richmond, some old maps show the evidences of the laying out of the village of Willsonburg. A short account of this abortive community by G. Neal Procunier was included in the Centennial Souvenir Book of Bayham Township, 1950, and is here quoted in full.

"In the early eighteen hundreds, Ambrose Willson came from Pelham and established a saw-mill on the Big Otter, on or near the land now owned by Mr. and Mrs. Hanlon Pritchard. At some little distance he built a general store to accommodate the many men he employed in the extensive business they operated. Ambrose Willson operated the saw-mill and Andrew Moore took charge of the store.

"In time other business ventures were established, a grist-mill, a carding mill, a fulling mill, and the thriving little business centre was known as Willsonburg. The above information was obtained from the writings of Mrs. Elgin Hatch.

"There was also a blacksmith shop. The grist-mill survived the longest, and many men have owned it, among them Robert Procnier. He and his brother James used to operate it day and night. They ground wheat flour, hauled it to Corinth with teams, and shipped it by railway to New Brunswick.

"Willsonburg has been gone for a long time now, but the old mill building still stands and is in the possession of Mr. and Mrs. Hanlon Pritchard. Mrs. Pritchard inherited it from her father, Mr. Richard McCurdy, who used to operate it about twenty years ago.

"Instead of the whine of the saw and the roar of the mill dam, the murmur of bees is heard from Mrs. Pritchard's bee yard. The mill dam is broken and the mill wheels are quiet, but the historic old place on the Otter Creek is still a beauty spot for tourists and for fishermen."

Corinth

This is a small, unincorporated community located at the intersection of the Tenth Concession road with the side-road between Lots 5 and 6, in the north-west part of Bayham Township. The names of the original patentees of the lots that occupy the four corners, and the dates of their Patents, are as follows.

Concession IX			
Lot 5, South half	Edward Borbridge	Feb.	25, 1856
Lot 5, North half	John Borbridge	June	21, 1859
Lot 6, South half	Nicholas Dupiel, as the assignee of Jacob Jones	Oct.	12, 1843
Lot 6, North half	John Jones, Jr.	May	25, 1848
Concession X			
Lot 5	Henry Kipp	Oct.	19, 1839
Lot 6 (Crown Reserve)	Canada Company	Feb.	17, 1837

Of these men, Jacob Jones, John Jones, Jr., and Henry Kipp were "Settlers located by Colonel Talbot". Edward and John Borbridge bought their land from the Government, for Lot 5 in the Ninth was a Clergy Reserve lot.

Other early pioneers in the neighbourhood were F.A. Best, Isaac Connor, John A. Denton, Robert Donaldson, Robert Dalrymple, D. Donahue, W. Walter Firby, William Fenn,



Otterville about 1874-76 — a sketch made by W. Moore "from the residence of W. Watts", N.W. of the village. In the foreground the woollen mill (right), saw mill, casket factory, tannery and the Lossing flour mill (left). The shingle and match factories appear behind the flour mill to right and left.



The Treffry Flour Mill, Otterville in 1955. This mill can be identified in the above sketch. It is little altered externally since 1875 or since it was built more than a century ago. The first mill here was built in 1807.

Thos. M. Ford, James Ford, Isaac Hayward, Noble L. Kerr, William Moore, Guildford Marr, Cornelius Neff, James G. Rickwood, E.A. Weaver, Thomas Weaver, Jacob Stimers, Henry Best, and Casper Best.

First known as Jones' Corners, it was given the name of Corinth when it became, in 1871, a station on the Air Line Railway. In 1950, Corinth had two general stores, a post office, two churches, one cheese factory, one grist mill, and one garage.

Otterville

The village of Otterville celebrated its Centenary in 1907 with, among other things, the publication of a valuable Souvenir booklet, in which the history of the early years of the settlement is reviewed.

According to the Souvenir booklet,

"In 1807, one hundred years ago, amid the great forest of white pine, the first settlement of Otterville was made. There was a grist and saw mill built below the forks of the Otter and Sweets Creek and a little above the present dam.

"John Earl and Paul Avery, who had a grant of land, and also some machinery, given by the government, were the owners. The first white child born in South Norwich was Peter Avery, in 1810. John Earl and Paul Avery sold their mill to Cook and Galloway, who were succeeded by the Cromwells. The Cromwells built a second and larger mill a few feet below where the present flour mill now stands."

"About 1831 Peter Hamilton and William Hardy built an iron smelting furnace a short distance down the river [Lot 12, Con. X] where they procured good water power. They brought in a great quantity of iron ore from Middleton. The river, being thought navigable, was surveyed from the lake up. But before affairs were completed an accident happened to the furnace and the enterprise was abandoned. In 1833 Asa Durkee built a tannery and started a shoe and harness business."

It has been pointed out in a previous chapter that the greater part of the Township of Norwich (as it was then) was granted in large blocks to absentee owners, and that almost all of the grants so made were patented in the year 1800. At the same time, two-sevenths of the lots in each concession were reserved for the Crown and the Clergy. An

examination of the Domesday records for the eastern half of the Township of Norwich South (in which Otterville is included) shows that what is true of the original whole township is equally applicable to its south-east quarter: the extent of such large grants, including the reserves, in Norwich South Township, Lots Numbers 1 to 14, is as follows:

To William Willcocks	30 lots	6,000 acres
To Robert Hamilton	15 lots	3,000 acres
To Robert Addison	15 lots	3,000 acres
Crown Reserves	12 lots	2,400 acres
Clergy Reserves	12 lots	2,383 acres

Total 84 lots 16,783 acres

In the foregoing table, 60 lots (5/7ths of the whole) are shown as granted to absentee owners; and 24 lots (2/7ths of the whole) are shown as reserved. And all are accounted for. It would seem, therefore, that what the Souvenir booklet refers to as a grant of land to John Earl and Paul Avery must have been obtained by purchase, or by some other mode of acquisition, from the original grantee.

Extending as it does along its principal east-west street for a matter of about a mile and a half, Otterville occupies a part of each of ten lots: Nos. 10 to 14, in Concessions VIII and IX. These ten lots are recorded in the Domesday Book as follows:

Con. VIII	Lot 10	to Robert Hamilton	Sept. 4, 1800
	Lot 11	to Robert Hamilton	Sept. 4, 1800
	Lot 12	to Robert Hamilton	Sept. 4, 1800
	Lot 13	Crown Reserve, later to Kings College	Jan. 3, 1828
	Lot 14	to Robert Hamilton	Sept. 4, 1800
Con. IX	Lot 10	Crown Reserve, later to Kings College	Jan. 3, 1828
	Lot 11	to Robert Hamilton	Sept. 4, 1800
	Lot 12	Clergy Reserve, leased to George Ryerson	Nov. 6, 1818
		sold to John C. Cromwell	Dec. 19, 1860
	Lot 13	to Robert Hamilton	Sept. 4, 1800
	Lot 14	to Robert Hamilton	Sept. 4, 1800

The site of Earl and Avery's grist and saw mill is described as "below the forks of the Otter and Sweets Creek and a little above the present dam". The description fits the

south end of Lot No. 11, in the 8th Concession; Lot 11 in the 8th Concession was one of the lots patented in 1800 to the Hon. Robert Hamilton, of Niagara. Hamilton, then, was the original grantee from whom Earl and Avery obtained their "grant".

In a letter addressed to the Editor of the Review (presumed to be the Woodstock Review), a writer named Milton Cameron, about the year 1878, reviewed his "Reminiscences of Pioneer Life in South Norwich". His account differs considerably from that given in the Souvenir booklet, and affords a good example of the variation to be found in personal recollections unsupported by authentic written records.

"At the early date of which we write, the northern part of Norwich Township was known as the Upper Settlement, and the southern part of the township, of which alone our sketch will treat, was known as the Lower Settlement.

"The first settlers who took up their abode in what is now South Norwich Township, came here in the year 1808, and located themselves as follows: - Along Spitler Creek, between the 6th and 8th concessions, Anthony Sells, Joe Spitler, John Philips, John Philips, jr., Archie Philips; around Otterville were located, Robert Sweet, Joseph Stafford, Seeley Stiles, and a man named Barton. In the same year Cook & Galloway built the first house on what is the present site of Otterville, and, finding such an excellent mill site there, proceeded at once to erect the first grist and saw mill which ever ornamented Otter Creek. From this circumstance the place took the name of Otter Creek Mills, which it retained for many years.

"This first mill was a rather primitive affair, being only 18 feet square, built of two-inch plank, dove-tailed together at the corners. This mill occupied the site where the Otter carding and fulling mill at present stands. As there were no means for bolting flour in this mill, it merely ground the wheat without bolting it; until a later day when a bolting cloth was put in, to which the meal was conveyed in bags by the miller, as elevators were not yet introduced."

"Our settlers had not been long here, before their number was augmented by the birth of the first white child born in South Norwich, who was Sarah Gilbert, born in 1809. The first marriage in our township occurred in 1813, when Miss Brennis Cook of Otter Creek Mills, was united in marriage to Mr. Gilbert Harris of West Oxford. The first death was a lad, aged 16, Royal Sweet, son of Robert Sweet. The cause of death was white swelling on the knee."

"The first house of worship was a log (structure) erected by the society of friends (and) situated on the plot of ground (in) Otterville, now occupied (by) frame church." [The paper is torn at this place, and the words enclosed in parentheses have been supplied; the paper gives no clue to the name of the "frame church".]

"The first licensed tavern was built of logs, by Asahel Oatman, in the year 1830. It was first kept by Stephen Yarrington, and occupied the site in Otterville on which the Cleveland house afterwards stood.

"The pioneer school-house was built in the year 1812, and was situated on the Eastern high banks of the Spitler, near the seventh concession. As this building differed somewhat, in architectural design and construction, from the school-house of the present day, a short description of it may not be uninteresting. It was 16 x 18 feet on the ground, walls built of round logs; roof built of logs carried up to a peak; these were covered with shingles four feet in length, held to their places by poles running lengthwise of the roof. The door was made of rough boards fastened to cross cleats by wooden linch pins; the windows were slits in the wall covered with oiled paper. A thorough system of heating and ventilation, was secured by means of a fire-place seven feet in width, built of mud and sticks. Thus not a nail, nor a pane of glass, nor a stone nor brick was used in the construction of the whole building. Here the young idea was taught how to shoot by John Philips, jun., who taught the first public school in South Norwich.

"The first store in South Norwich was built in 1816 at Otterville, and was kept by William Holmes. It was a log building and stood on the flats a few rods south of where the bridge now crosses Otter Creek. Before the erection of this store our settlers found it very difficult to secure supplies of groceries. For soda, they used the ashes of burnt corn cobs; as a substitute for tea, they steeped the leaves of a shrub which they found growing on the plains; and in the year 1813, salt could hardly be obtained at any price. Squire Haley in that year gave a dressed hog weighing 240 lbs. in exchange for 40 pounds of salt. To add still further to their embarrassment, a famine occurred in the year 1816, when our settlers were obliged to live for four weeks on green wheat boiled in milk.

"The first post office was opened at Otterville, in 1830, by John Cornell; this being the third post office opened in the county. Norwich opened also in 1830, claiming to be the second, and Ingersoll opened in 1821, being the first.

"The first magistrate was Solomon Lossing, who received his commission as a Justice of the Peace in the year 1829.

"The first concession opened in our township was the eighth, which in 1827 was opened from Springford

"to the east quarter town line. Previous to this, the only roads were crooked bush paths meandering from one neighborhood to another.

"The first apple orchard was planted in 1810, by John Philips, on the farm now occupied by James B. Johnson; where some of the old trees are still standing."*

That part of Otterville, at the extreme west end of the village, which occupied both sides of the road in Lot No. 14, was known as Erbtown, after Mr. Abram Erb, who owned part of this lot both north and south of the road.

Peter Lossing's map of Norwich Township, 1820, shows the Friends' Meeting House (referred to in the "Reminiscences of Pioneer Life", in the passage quoted above) on the south side of the road, Concession IX, Lot No. 13, one of the lots that had been patented to Robert Hamilton. As indicated in the somewhat mutilated paragraph, the site was later occupied by a frame church; it is still (1957) the site of a cemetery.

Lossing also gives the names of the owners of Lots Nos. 10, 11, and 12, in the 8th Concession, as "Cromwell and Haight", apparently joint owners. The corresponding lots in the 9th Concession, south of the road, are marked "for sale".

In 1834 and 1835, a bitter dispute raged in the Township of Norwich, when Deputy Provincial Surveyor Eliakim Malcolm, undertook to adjust the boundaries that had been run by Peter Lossing. In his report, dated March 19th, 1835, Mr. Malcolm makes a passing reference to the village that is now Otterville.

"William Cromwell has laid out a village adjoining his mills - allowing the road all on the North side of the line run in front of the Concession, and several large buildings are placed accordingly - also the bridge across Otter Creek."

* Clipping in possession of Mrs. R.M. Holmes, Otterville.

Another Deputy Surveyor, Mr. John A. Tidey, March 27, 1835, offered the following comment on Mr. Malcom's statement, with which, it is evident, he did not agree:

"The buildings at Cromwell's, on the line between the 8th and 9th concessions, are neither very large nor very costly, and the bridge across the narrow Otter, is but a common rough country bridge. Many of those buildings were latterly erected while suits were pending, as if to dare the laws, and the stability of ancient surveys."

A petition submitted to the House of Assembly in November, 1834, bearing the names of 125 "inhabitants, freeholders and residents of the Township of Norwich", had thus described the situation at Cromwell's Mills:

"a small space on the Ninth concession line, where in only one place a few buildings have latterly been erected near the South side of the line, which buildings have many of them been built within the present year, in a pertinacious and daring manner, even while the above named suit was pending."*

Such were the stormy times that attended the founding of the village of Otterville.

The following passages are extracted from the Centennial Souvenir Booklet, 1907, which contained "A short historical sketch of the picturesque village of Otterville".

"Between 1850 and 1860, in and around Otterville, were the sites of no less than twelve steam and fourteen water mills, all cutting lumber, and nearly as many more making shingles.

"Until 1870 the lumbering of white pine, which covered the land, formed one of the principal industries. Many other business enterprises were started, some of which have continued to the present day (1907).

"After Edward Bullock bought from John C. Ferrie, in 1845, he built a custom woollen mill and the present flour mill. About 1854 there were a number of other industries. A foundry was built by David Stage, one of the products being the bell on the school house, which still calls the children to the seat of learning. The Erbs' saw and woollen mills, J.G. Williams' distillery, stock stables, and grain warehouses, John Furlong's shingle and cooperage shops, the Parsons carriage works, also a canning factory, potash works,

* Report on the petitions relating to survey of the Township of Norwich. Journal of Assembly of Upper Canada, 1836: Appendix, Vol. III, Report No. 116.

"Warner's match factory, and John McFarlane's carriage and blacksmith shop, which is still carried on by Alexander and John McFarlane.

"During all this period there was no railroad within many miles of Otterville, and all the lumber, shingles, and other products had to be teamed to Port Dover, Woodstock, or Ingersoll. Great need of a railroad had been felt for a long time, and as early as 1850 there had been an agitation for one. Indeed, the construction of a railroad was begun by the Woodstock and Lake Erie R.R. Co. In 1854 it was so far advanced that nearly all the grading, fencing, and bridging was completed and the ties delivered, ready for the iron rails. Then the great Desjardine disaster occurred in which the chief promoter of the road, Mr. Zimmerman, was killed, and the work came to a stand. Some years later the two big bridges here were taken down, rafted to the mills, cut up and made into matches at the Warner factory.

"About 1872 plans were renewed for the construction of a railroad; through the efforts of J.E. Bullock and the late Gilbert Moore of Norwich, Woodstock and Simcoe people were interested in the new scheme. The Port Dover and Lake Huron R.R. (as this one was called) took nearly the same survey as the old W. & L.E.R.R., being the old idea revived. This railroad, when completed, was not the great benefit that was anticipated to Otterville, as pine timber lands were then about all cleared. Besides there were other railroads, the Canada Southern, the Brantford and Tillsonburg, and the Great West Air Line, all built about the same time, so that within a radius of twelve miles of the village there are twenty stations.

"The change from the lumber industry to agriculture had been gradual, but sure, as little by little the old white pine stumps were uprooted and the land cleared. South Norwich farms can now bear comparison with any others in Oxford, and good roads, fine buildings, and prosperous farms are the rule. Much attention is given to stock raising, Otterville being a flourishing market for hogs. Cheese making is also a substantial source of revenue.

"That our village of today (1907) is in a prosperous condition is proved by the large mercantile business done in the stores and other places of business. Two sawmills are still in operation cutting hardwood lumber. Among the public buildings are three churches, school house, town hall, Oddfellows' hall, and Foresters' hall. In 1893 Otterville was made a police village, and since then the improvement has been marked."

Burgessville

This village occupies parts of four lots, being the four corners of the intersection of the road between the first and second concessions with the "Middletown Line Road"

(between Lots 14 and 15), in the Township of Norwich North.

The original Patents for these lots were granted as follows.

Con. I, Lot 14	William Willcocks	July 22, 1800
Lot 15	Rev'd. Edmund Burke	Sept. 4, 1800
Con. II, Lot 14	William Willcocks	July 22, 1800
Lot 15	Rev'd. Edmund Burke	Sept. 4, 1800

Peter Lossing, in 1820, shows Lot 14, in the first concession, belonging to Aaron Corbin; the other three are marked with initials for which no explanation is offered:

Con. I, Lot 15	L M
Con. II, Lot 14	P M
Con. II, Lot 15	E M

On the reverse side of the Lossing map, the legend, presumed to have been written by Benson Lossing, Peter's son, reads, in part:

"the unlocated Land is generally for Sale in the Township at about \$3 pr. acre Large Tracts for easy payments the unsettled Lots (mark) initials also mostly for sale".

The following passages are taken from the account of Burgessville, in the Norwich Centennial Souvenir book, 1810-1910.

"It was first named Snyder's Corners, after Elias Snyder who came in 1811. who was the second teacher in the township and continued as teacher for several years, but afterwards took up land Joshua Corbin was another early settler who settled near where the village now is, in 1816. The Dennis family settled near Burgessville in 1820, and there are a great many of them still residing in the vicinity, the street running west from the four corners is named Dennis Street. Capt. Joshua Jacques moved into Burgessville in 1835, and was one of the prominent families in the early history of the village. William Topham was one of the early settlers of Burgessville, and cleared a farm in the forest The Emighs are also a pioneer family coming to the settlement near Burgessville in 1819 E.W. Burgess, for whom the village was named, was born in the vicinity about 1821, and started the business of blacksmithing in 1844

"The first school buildings were log, then frame, and now a commodious brick. In 1833 Mr. De Los Hewitt was teacher; Mr. Snyder, the pioneer, and his son Elias Henry, were both teachers in the vicinity."

"In the early days there was no doctor in the neighborhood, and for a number of years Dr. Cooke, who settled in the township in 1831, was the only doctor in the township."

Cornell

Not much is left in the year 1957 to mark what was at one time a flourishing little village, the centre of which was on Lot No. 15, in Concession X, Township of Norwich South. The history of Cornell is told at length in an anonymous manuscript, written in 1927, and at present in the possession of the Tillsonburg News. Much of its earliest history is shared in common with the early history of the township, and that of Otterville.

It was about 1855 that the two brothers, John and Samuel Cornell settled in this vicinity and laid out part of Lot 15 into village lots, and called their venture Cornell. Here also they built a store, a warehouse, and a meat-packing house on the north-west corner of the road intersection.

"For many years Cornell was the central grain, egg, and pork market for the country for miles around. Waggon's were sent out by the Cornells to collect eggs from the farmers as far west as St. Thomas, and east as far as Port Dover. The farmers teamed their grain here and sold it and their pork, to these energetic men who cured it and then shipped it by waggon trains to Woodstock or Brantford, and thence to New York.

"The population of Cornell increased quite rapidly.

"Mr. L. Woodward set up a blacksmith shop. just west of the Cornell warehouse.

"A carriage shop and blacksmith shop were built by Dan McCormick near where Alvin Daikin lived.

"On October 9, 1870, the Township Council passed the 3rd reading of a by-law to issue a certain sum of money for the construction of the Canada Southern Railway, now the Michigan Central Railroad, through the Township of South Norwich. In the summer of 1872, ties were being laid, and the construction of the railroad going on in front of where Cornell Station now stands.

"A large hotel was built by John Wood on the north-west corner of the lot where Charles Clifford lives. A shoemaker, John Clum, started up in business in the village.

"The old log school-house where many of our forefathers learned their ABC's stood near the site of the present school. About 1863, Phoebe Moore, later Mrs. Luther Oatman, was the teacher. In 1865, the present building was erected.

"The Church of the Messiah stood east of the ravine on E.E. Hicks' farm, and the parsonage just east of it.

"John Sutherland built a large saw mill on the banks of the Otter just south of Henry Weaver's farm. A large frame hotel was erected by Dennis Hicks, about 1872, just opposite where Clarence Stover lives.

"The Baptist Church was just west of the hotel.

"But misfortune overtook this busy little village and its founders. After the death of John Cornell, who was the best business man of the two brothers, business did not run so smoothly. The store, which served as a bank for the surrounding community, was robbed. A few years later, the store, warehouse, and pork-house were destroyed by fire. They were rebuilt of brick, but the financial loss was too great for the Cornell firm, and it went bankrupt. The buildings were abandoned and later torn down, and moved to Otterville, where the bricks were used in building the brick block now owned by J.W. Fish.

"Most of the timber being cut down by this time, the saw mills were moved away. The old Hicks hotel and the Messiah Church were moved to Tillsonburg a number of years ago.

"Not much remains now to show what a flourishing village Cornell once was."*

Springford

Earlier known as Springbrook, this village occupies the four corners of the intersection of the road between Concessions VIII and IX, and the sideroad between Lots 21 and 22, in the Township of Norwich South.

Lots 21, in both concessions, were among those granted to Robert Hamilton in 1800; Lots 22, also in both concessions, were part of the holdings of Capt. William Fitzgerald. On Peter Lossing's map, 1820, these lots appear marked as follows.

Con. VIII, Lot 21	John Philips
Lot 22	Josiah Gilbert
Con. IX, Lots 21 & 22	Aaron Simmons

In an unidentified issue of the London Free Press, presumed to have been published about 1949, Mrs. W.L. Addison, of Otterville, gives an account of the history of Springford. According to Mrs. Addison's account,

* Anonymous manuscript, in possession of the Tillsonburg News.

"The four farms that made up the four corners of Springford each had 200 acres, and on these 800 acres, the Bells settled on Lot 22 in the 9th concession of Norwich Township (it wasn't divided into North and South Norwich at that time); Haleys settled on Lot 22 in the 8th concession; Anstices on Lot 21 in the 8th concession, and Dyer Wilcox on Lot 21 in the 9th concession."

It would appear that transfers of ownership of farm lots in the Township of Norwich were not infrequent occurrences. Mrs. Addison's story of the "Springford Pioneers" is quoted below.

"There have been five generations of Bells living on the farm to which (William Bell's) grandfather Michael Bell came in 1835. His father Richard Bell, came with his parents from the County of Northumberland at the age of 14, and lived at Springford until his death at 92. Mr. Bell's mother, Eliza Heavoner, also came to Canada when 14 from Limerick, Ireland, and lived to be 83.

"When Mr. Bell's grandparents, Mr. and Mrs. Michael Bell and their family of five, two boys and three girls, landed at New York, they came up by the Erie Canal to Buffalo, except 18 miles of railroad, the first railway in America, then by boat to Port Burwell. When they reached Port Burwell, the lake was very rough, too rough to land, and they were taken on to Port Stanley, and the captain told them he would land them on the trip back to Buffalo if he could, and if not he would take them on back to Buffalo. However, they were able to go ashore at Port Burwell, and after resting there for a couple of days, they hired someone to take them and what luggage they had to Dereham Forge, now called Tillsonburg. They stopped at the home of the first Mr. Tillson, who lived where Kenneth Anderson's service station now stands. The trip of 16 miles took from sunrise till ten o'clock at night at that time, on August 18th, 1835. The Tillson family had only room for the mother and three girls, so the father and two boys slept in the shed.

"The Burns family and the Wardle family were both from the same part of England, the Burns family coming in 1832, and the Wardles in the spring of 1835.

"The Bells located for a few weeks on lot No. 7 in the 7th concession of Dereham, but Michael Bell eventually bought the present Bell home from Charles Hardy's father. [That is, William Hardy.] He's the man that started a smelting outfit down on the Otter Creek, south of Otterville, on property now owned by the Ball family.

"In the old country, Grandfather Michael Bell was a miller. He went down one day to buy the Otterville Mill, but it had been sold the day before.

"The first purchase the family had to make when they landed at Springford was a grindstone to keep their axes sharp for cutting down the timber, and they had to get that by driving a yoke of cattle to Dereham Forge. There were no roads, but, with a hand made

"sled and the two cattle, made the angling trip across to Dereham Forge to buy the grindstone. Tillsonburg had no buildings on top of the hill at that time.

"Richard Bell had two boys and one girl, but William Bell was the only one to stay right in Springford, and he took over the old farm. There have been five generations of the male line still on the same farm.

"The Haley family can go that one better, as six generations of the same family have been on one farm, Grant Haley being the fifth, and his son Lee the sixth. The Haley family came from Nova Scotia in 1811.

"Mr. Bell said, 'Old Mrs. Haley never wanted to come to Canada; she had a dread of coming here on account of the Indians. One morning she woke up and said to her husband: I'm ready to go to Upper Canada with you; I had a dream that I was in Upper Canada, in a shack in the woods, and you were away, and several Indian braves came into our home and stayed all night. They played with the children, petted and fondled them, and when they were ready to sleep just took their blankets and laid down on the floor and went to sleep, and I received no harm whatever from them'.

"Uncle Ebenezer Haley told me that his father had paid \$100 for a barrel of salt. It was a precious necessity. Old Mr. Haley at different times carried a bushel of wheat clear to Long Point, about 35 miles, to get it ground. At that time it was all ground together, no bran or shorts taken from it. Then he carried it home on his back. The Gilberts, Haleys, and Spitlers were living around Springford before the Tillsons came to Tillsonburg. Springford wasn't called by that name originally; it was called Springbrook, and if the brick veneer was taken off the front of the United Church, they would find that name painted on the front of the Church yet. It was found there was another Springbrook in Upper Canada, so it was changed to Springford on account of the little stream that runs down through the village.'"

Milldale

Lot No. 7 in the 8th Concession of the Township of Norwich (now Norwich South), was one of William Willcocks' lots which was bought by Peter Lossing and his associates in 1810. Lossing's map, 1820, does not indicate the name of an owner at that date. Through the north half of this lot flow two streams, the main stream of Otter Creek, and a tributary known as Crystal Creek. Each of these streams, in this half-lot, supplied power for the operation of a mill; and the little hamlet that grew up around the mills was known by the

appropriate name of Milldale. The sideroad between Lots Nos. 7 and 8 was the main travelled road between Otterville and Norwich; from the main road, a spur road led to the "first mill dam", on Crystal Creek, where, in the 1890's, Frederick Watkins' saw and cooperage mill was located, and where, in season, he also operated a cider mill.

Continuing northward over the rising ground between the two streams, the spur road led to the "Old Red Mill", a grist mill, operated by Duncan McNaughton.

"And so we leave the Old Red Mill and travel on beside the pond's edge till we come to the foot of our last hill below the farm of Edwin McMullen. Here are two wonderful springs with his spring-house on the right, and to the left a spring which fed into the Otter Creek

"At the top of this hill set back of a bower of lilac bushes was the friendly McMullen home. Once a prosperous dairy and poultry farm, it was one of the first to convert to tobacco. Just around the corner was the cottage of Ephraim C. Stover

"This then is the end of the old mill road, and at this corner stood the 'Friends' Church', which was a large, plain, white frame building with an uncovered verandah facing towards the Norwich-Otterville main road. This church was given by William Potter Barker to the Friends' Society in 1877, and his son James Frederick Barker was the first minister. There was a large rambling church shed to house all the teams and family phaetons, and the Quakers (as some called this sect) brought all their family to the House of God.

"And now (1949), fifty years later, little remains of the Milldale of olden days. The mill dams are gone, the mills and the houses where the millers lived are torn down, as is also the historic Friends' Church and its long, roomy church shed. Even the road is closed where the mill dams were."*

* Norwich Gazette, August 25, 1949. Contributed by Mrs. G.E. McVittie, daughter of Ephraim C. Stover.

CHAPTER 5

MILLS

Before the year 1825, there are few reliable records of mills in the Otter Creek Watershed. Such as have been found are here briefly summarized.

Early accounts of Norwich Township state that John Earl and Paul Avery, about 1807, built a grist-and-saw-mill near the conference of Sweet's Creek and the Otter, on land that is now Otterville. With that statement, the "old-timer", Milton Cameron, in his "Reminiscences of Pioneer Life in South Norwich", previously quoted, does not agree:

"In the same year (1808), Cook & Galloway built the first house on what is the present site of Otterville, and proceeded at once to erect the first grist and saw mill which ever ornamented Otter Creek."

In a road description dated April 8, 1829, the mills in question are referred to as "Cromwell's Mills, in the Township of Norwich;" and a report contained in the Journal of the Legislative Assembly, dated April 22, 1839, refers to the same mills as "Cromwell's, 9th Concession of Norwich".. So far as can be ascertained, these mills, whether the same building, or a succession of buildings, have passed through the hands of the following owners, in the order given.

John Earl & Paul Avery	1807 -
Cook & Galloway	- 1824(?)
Cromwell & Schooley	1824 -
William Cromwell, in 1829 and until	- 1839
John C. Ferrie	- 1845
Edward Bullock	1845 - 1877
E. M. Schooley	1877 - 1880
S. B. Lossing	1880 - 1949
Lorne Treffry	1949 - (1957)

Peter Lossing, in 1820, on his map of Norwich Township, does not show a mill at the site of Otterville. He shows a sawmill belonging to John Throckmorton, on Lot 23, Concession III; a sawmill belonging to William Hilliker, on Lot 2, Concession V; and a sawmill belonging to Solomon Lossing, on Lot 2, Concession VII.

The Historical Atlas of Elgin County, 1877, refers to the founding of the village of Richmond (Bayham P.O.).



Clutton's Grist Mill at Vienna about 1918. The larger building beyond the bridge was then Robinson's Canning Factory, but had been a woollen mill. Note the uprights of an earlier bridge in the river below the one then in use, evidence of bank erosion. This bridge has been rebuilt again since the photograph was taken.



The "McCurdy" Mill, Lot 113, North Talbot Road, Bayham Township about 1925. This mill site was occupied by "Birdsall's Sawmill" by 1831, but was best known as the site of Knott's saw, grist and woollen mills from 1893 until about 1920. The buildings shown replaced those burned soon after the end of the Knott ownership.

"In 1816 Caleb Cook settled here, and Noah Cook soon after built a saw and grist mill on the Little Otter." Noah Cook obtained his Patent of Lot No. 121, North Side of Talbot Road; and Caleb Cook's lot was No. 111, South Side of Talbot Road. The Atlas does not identify the location of the mills. There is a reference to Noah Cook's Mills in a description of a "Quarter Sessions Road", dated March 26th, 1822; but this also fails to give the location, implying only that it was on the Little Otter Creek, now known as the East Branch of Otter Creek.

The Atlas also tells of an early settler in Bayham Township, Mr. Samuel Howie, who, in 1817, occupied 200 acres in the 7th Concession, and whose "first taste of bread from genuine flour was obtained by balancing two bushels of wheat across his ox yoke, and thus getting it with the help of the oxen to Jesse Smith's mill, on Teal's Creek, a small stream near Vienna." A road description dated June 19, 1834, refers to "the mills belonging to Jesse Smith" at the village of "Shrewsberry", now Vienna.

From 1825 to 1846, the municipalities of Upper Canada made annual returns of much interesting statistical information, derived from their assessment rolls; and these were published in the Journals of the Legislative Assembly of the province. From that source have been assembled the data given in the following tables, the first showing the numbers of sawmills, the second the numbers of grist mills, in the seven townships that comprise over 97 per cent of the watershed. It is to be borne in mind that in some townships, notably Burford and Malahide, a considerable proportion of the mills reported were outside the watershed of the Otter Creek.

After 1846, the assessment returns became incomplete and unreliable, and by about 1851 were discontinued altogether.

	Year	Bayham	Burford	Dereham	Houghton	Middleton	Malahide	Norwich	Total
SAW MILLS 1825 TO 1846	1825	7	2	-	-	1	3	4	17
	1826	7	2	-	-	1	5	4	19
	1827	8	2	-	-	3	5	3	21
	1828	13	2	-	-	3	6	3	27
	1829	11	2	-	-	3	7	6	29
	1830	11	3	-	-	3	6	6	29
	1831	10	3	-	-	4	5	6	28
	1832	14	4	1	-	4	7	6	36
	1833	15	4	1	-	5	7	6	38
	1834	15	5	1	1	5	7	7	41
	1835	14	4	3	1	5	6	6	39
	1836	14	6	3	3	4	7	8	45
	1837	(not reported)							
	1838	19	3	2	-	-	10	7	41
	1839	17	5	2	4	3	10	7	48
	1840	20	4	3	4	3	8	8	50
	1841	23	5	3	-	3	11	9	54
	1842	28	7	3	4	7	12	8	69
	1843	26	-	-	5	8	14	-	53
	1844	25	9	2	6	7	17	7	73
	1845	25	9	4	6	7	16	12	79
	1846	27	10	5	7	9	13	12	83
GRIST MILLS 1825 TO 1846	1825	3	-	-	-	-	2	2	7
	1826	5	-	-	-	-	4	2	11
	1827	4	-	-	-	-	3	2	9
	1828	5	-	-	-	-	2	2	9
	1829	4	-	-	-	1	2	2	9
	1830	1	-	-	-	1	3	2	7
	1831	3	-	-	-	1	3	2	9
	1832	4	-	-	-	1	3	2	10
	1833	4	-	-	-	1	4	2	11
	1834	4	-	-	-	1	4	2	11
	1835	3	-	-	-	1	4	1	9
	1836	6	-	-	-	1	3	3	13
	1837	(not reported)							
	1838	3	-	1	-	-	2	3	9
	1839	4	-	1	-	-	3	3	11
	1840	4	1	1	-	-	4	3	13
	1841	3	1	1	-	-	4	3	12
	1842	3	1	1	-	-	4	3	12
	1843	3	-	-	-	-	3	-	6
	1844	3	1	1	-	-	3	4	12
	1845	3	1	1	-	1	3	3	12
	1846	3	1	1	-	1	5	4	15

1) *Timbers of the dam at Jeremiah Moore's Grist Mill, Lot 3, North Talbot Road, Bayham Township. A public road to this mill from the village of Richmond was established in 1832. The remains suggest that the dam had a timber core — an early type of construction that continued to be used for more than a century.*



2) *The site of Beatty's dam, Lot 6, Con. 6, Bayham Township. The timbers in the foreground are the foundation of the crib abutments of the floodgate. They show notches for cross-timbers forming the cribs. Cribs filled with boulders were resorted to after 1830 in an attempt to limit flood damage. In this case the bridge was not part of the dam.*

3) *The dam at Rock's Mills between Otterville and Tillsonburg — an example of scientific modern construction.*



It is quite impossible, in 1957, after the lapse of more than a hundred years, to identify the mills whose gross numbers only are reported in the assessment returns of the years indicated. A quick survey of the watershed, "on the ground", and an examination of such records as it has been possible to assemble, have provided the basis of a considerable number of notes, which, it is hoped, may, in turn, prove to be "pegs" on which further information may be hung.

Mills in Bayham

1. A road description dated July 11, 1831, refers to Birdsall's Saw Mill, northwardly from the village of Richmond, perhaps on the site of the more recent "Knott's Mill".
In the same vicinity, perhaps on the same site, a road description dated, April 8, 1839, refers to "Andrew Moore's Dwelling House and the Grist Mill", and continues: "I put up Notices, one at Williams and Moores Mills".
In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows, on the south half of Lot No. 113 North of Talbot Road, two mills, one on each side of the Otter Creek, at or near the site of "Knott's Mill".
Information supplied in 1955 by Mrs. Hanlon Pritchard indicated that "Knott's Mill" was on Village Lot 113 (of the Village of Willsonburg), in the 7th Concession of Bayham, and that successive proprietors had been: Wilson; Robert Procunier, 1885; Robert Knott, 1890-1920; Clayton Godby, 1920; Richard McCurdy, 1920-1922; Mrs. Hanlon Pritchard, 1922-1955; Orland Kinsey, 1955.
2. A road description dated April 10, 1832, defines (in part) a road as "Commencing near the Mill of Jeremiah Moore in Bayham, and running across Lot Number one hundred and ten North of the Talbot Road"
A road description dated April 8, 1839, is of a road which, at a point about one mile north of the village of Richmond, continues "across Jeremiah Moore's Mill Creek", which joins the Otter Creek near the site of Knott's Mill.

In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill, on or near the site of Jeremiah Moore's Mill, on the south half of Lot No. 110 North of the Talbot Road.
In 1955, the remains of a dam, at the point indicated in the Historical Atlas, were photographed by an investigator from the Department of Planning and Development.
3. A road description dated October 13, 1836, defines a road that extends southward from the village of Richmond, about five-eighths of a mile, "to the South East angle of Jacob Birdsall's Grist Mill".
A road description dated October 9, 1847, refers to the same road as the foregoing: "from the Village of Richmond on Talbot Road, Southward to Birdsall's Mills".
4. The Historical Atlas of Elgin County, 1877: "Many mills were built, and especially from 1840 until 1855 lumbering was the industry of Bayham". No locations identified.

5. A road description dated October 9, 1847, refers to an unidentified saw mill, on or near Lot 25, Concession V, of Bayham Township, on Little Otter Creek.
6. A road description dated October 7, 1848, refers to "the water privilege of John Elliott", on Lot 15 or 16, Concession II, Bayham Township, near Vienna.
7. The Historical Atlas of Elgin County, 1877: "In 1849, there were twenty-nine sawmills in the township". No locations identified.
8. The Historical Atlas of Elgin County, 1877, refers to three mills at Port Burwell, two of them on "the island":
 - (a) "Hamilton's mill, on the island, was built by Brainard in 1853, destroyed by fire in 1873, and not rebuilt".
 - (b) "Shaw and Williams' mill, also on the island in the Otter, would cut 40,000 feet per day".
 - (c) "Brunson's, under the management of A.T. Cutler, Esq., cut immense quantities".
9. In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill on the Little Otter Creek, on the north side of the Lake Road, in Lot No. 14, Concession I, Bayham Township. Erosion of the lake shore has encroached on this site, until, in 1957, the dam is just at the water's edge of Lake Erie.
10. The Historical Atlas of Elgin County, 1877, states that "at present the village (of Vienna) contains one flouring mill two steam saw mills". They are not otherwise identified.
11. Information gathered from various sources in 1955, indicates that there was a saw and grist mill at Vienna, on Lot No. 19, Concession III, Bayham Township, originally built about 1873; repaired in 1930; destroyed by flood in April, 1937. One proprietor was S.S. Clutton; the latest, at the time of the final destruction of the mill, was James Beard. A photograph in which this mill is conspicuous, undated, is in possession of Mrs. Hanlon Pritchard, former owner of Knott's Mill, north of Richmond.
12. Information supplied by Mr. Howard Palmer, of Vienna, indicates that there was formerly (dates not known) a carding mill on Lots 15/16, Concession III, at Vienna. The site has been much altered by highway construction at that point.
13. In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill on the south side of the road between Concessions II and III, (the "Otter Valley Road"), on Lot No. 24, on the land of Richard McCurdy, on Little Otter Creek. Mrs. Hanlon Pritchard, daughter of Richard McCurdy, confirms this indication, and states that the mill was a saw mill.
14. On August 31, 1955, an investigator from the Department of Planning and Development photographed the remains of a dam, on Lot No. 6, Concession III, Bayham Township, on the main stream of Otter Creek, at a point about one mile and a half below Calton. This dam has not been further identified, nor any dates of operation verified.

- 15.. In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill on the north half of Lot No. 6, Concession IV, on a small tributary of Otter Creek, on the land of T. Holcomb. Investigation in 1955 indicated that this was a flour mill, built "in the 1850's", rebuilt in 1883, and destroyed by a freshet about 1888-1890.
16. Information obtained in 1955 from Mr. Ira Mitchell, then owner of the property, indicated that there had been a grist mill, later converted to use as a cider mill, on Lot No. 2, Concession IV, Bayham Township, near Calton; that it had been built about 1894; washed out in a freshet in 1912. The successive proprietors were: Darius Pritchard; Warrington Pritchard; Ira Mitchell (since 1915).
17. Information obtained in 1955 from the late Mr. John Timpeny, of Calton, indicated that there had been a saw mill on Lot No. 1, Concession V, Bayham Township, about one and a half miles north of Calton. The name of the proprietor was Harris. Dates of operation could not be ascertained.
In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill on the south half of Lot No. 1, Concession V, on the land of S. Cook, on the main stream of Otter Creek.
18. On Lot No. 6, Concession VI, Bayham Township, on the East Branch of Otter Creek, about three miles west of Straffordville, are the remains of a mill, known as "Beatty's Mill". These remains were photographed in 1955, and in 1956, by the Department of Planning and Development.
19. Information obtained in 1955 from various sources indicated that there had been a grist mill, later a saw and planing mill, finally a cider mill, on Lot No. 11, Concession VI, Bayham Township, at the south side of Talbot Road, about one and one-third miles west of Straffordville, on a small tributary of the East Branch of Otter Creek. The successive proprietors were Frank McQuiggan (about 1917); Harold McQuiggan; Charles McQuiggan; William Mitchell. Remains of the dam, of concrete, are (1957) still visible.
20. Information obtained in 1955 from various sources, indicated that there had been a mill, presumably a saw mill, on Lot No. 14, Concession VII, Bayham Township, on the East Branch of Otter Creek. Names of proprietors, and dates of operation, not identified.
21. Information obtained in 1955 from various sources, indicated that there had been a saw mill on Lot No. 22, Concession VII, on the East Branch of Otter Creek, built about 1850. The proprietor's name was said to be Hubbard. Dates of operation could not be ascertained.
22. In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill on the north half of Lot No. 1 Concession VIII, on a tributary of Otter Creek, on land belonging to Robert Firby. This is said to have been a saw mill. Dates of operation could not be ascertained.
23. Information obtained in 1955 from various sources, indicated that there had been a saw mill on Lot No. 10, Concession VIII, Bayham Township, on a tributary of Otter Creek. The name of the proprietor was said to be Nathan Howell.

NOTICE!

The subscriber, having just completed the refitting of his mills with new and

IMPROVED MACHINERY

is now prepared to do all kinds of

CUSTOM WORK

in his line, viz.,

Sawing Lumber and Shingles by the thousand, or on shares, also Planing and Matching to order, and on short notice.

Lumber and Shingles constantly on hand.

BILLS CUT TO ORDER!

Shingles per. M. \$2.00. Bill-stuff per M. \$8.50. A quantity of seasoned flooring on hand; also, a large stock of Furniture, Sash and Doors, which will be sold

CHEAP FOR CASH!

T. J. PENNINGTON,
SUCCESSOR TO SHAW & PENNINGTON.

Otterville, April 18th, 1877.

York's Job Press.



Rock's Flour Mill on the Otter halfway between Otterville and Tillsonburg in 1955. In spite of frequent damage to the dam in recurring freshets, this mill has continued in use for about a century. It has evidently been improved and enlarged more than once in recent years.

24. Information obtained in 1955 from various sources, indicated that there had been a saw mill on Lot No. 13, Concession VIII, on Otter Creek, about three miles north of Straffordville. The name of the proprietor was said to be Fraser. Some logs on which, presumably, the mill once stood may be seen on the north side of the creek, about two hundred feet downstream from the remains of a bridge that spanned the creek at this point.
25. In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill on the north half of Lot No. 16, Concession VIII, on a tributary of Otter Creek. No further identification is known.
26. From information obtained in 1955 from Mr. N. Stillwell, of Eden, there was a grist mill on Lot No. 17, Concession VIII, near Eden. The names of two successive proprietors were given as Walter Sindon; Stenebaugh. The dam was finally washed out by a freshet; the dates of operation were not ascertained.
27. In the Historical Atlas of Elgin County, 1877, the map of Bayham shows a mill on the north half of Lot No. 28, Concession VIII, on the East Branch of Otter Creek, on the land of H. G. Leach. Information obtained in 1955 indicated that this was originally a saw mill, later a shingle mill; that, from about 1870, the name of the proprietor was M. Leach; and that the dam was destroyed by a freshet about 1880.
28. Information supplied in 1955 by a son of Jacob Stimers, indicated that there had been a saw mill on Lot No. 5, Concession IX, Bayham Township, on a tributary of Otter Creek, about half a mile south of the village of Corinth. Jacob Stimers was the proprietor; dates of operation could not be ascertained.
29. In the Historical Atlas of Elgin County, 1877, the map of Bayham Township shows a mill on the south half of Lot No. 126, north side of Talbot Road, on a tributary of the East Branch of Otter Creek, on land belonging to W. Hodgkiss. No further identification is known.

Mills in Dereham

It was at the site of Tillsonburg that the founder of the town, George Tillson, erected the first saw mill in Dereham Township, "a very primitive construction". Here, in 1863, his son, E. D. Tillson was operating a saw mill, a planing mill, a sash-and-door factory, an oil-drilling machine, a flour-and-grist mill; while others used the water-power of the Otter and its tributary, Clear Creek, to operate yet other mills. These are the subject of considerable discussion in the columns of the Tillsonburg Observer, some of which is here quoted.

Sept. 10, 1863: "A short time since Mr. E. D. Tillson decided upon enlarging his grist mill to meet the

growing wants of the community. The old building was torn down and the proposed alterations at once proceeded with. Last week the frame of the new building was raised, and in six weeks, or thereabouts, will be again in running order. The size of the mill will be 74 by 34 feet, and about forty feet high. It will contain three run of stones, and two bolts - a farmer's bolt for gristing, and a merchant's bolt for flouring for market. We are pleased to learn that Mr. Tillson is preparing to enter on the manufacture of flour for the foreign markets, as it will prove a great benefit to the whole community in the vicinity of Tillsonburg, but especially to farmers, for flour, costing less for teaming to the railway in proportion to the bulk of grain used in its manufacture than wheat, Mr. Tillson will be enabled to pay the highest market price for all the grain he purchases. His enterprise and energy are deserving of success, and, we trust, will meet with it."

October 8, 1863: "The water power in the vicinity is enormous, and many excellent privileges yet remain unoccupied - and even those which are already in use are not worked to their full capacity. Some of the privileges are very powerful. One owned by Mr. E. D. Tillson on the Big Otter Creek drives the machinery of a saw mill, containing two large circular saws and one mulley saw, besides smaller saws for siding, manufacturing lath, &c.; of a planing mill, and sash and door factory; for drilling the oil well; of a flouring and grist mill containing three run of stones; and lastly, of Mr. Joseph Van Norman's shingle factory, and Mr. George B. Tillson's turning lathes. Besides the above establishments, Messrs. J. & M. Smith, of Campbellton, [name applied to the north-west quarter of Tillsonburg, and to the adjacent suburban area], have a fine new grist mill on Clear Creek, and Mr. Duncan McLaren a saw mill, the machinery of all of which is driven by the waters of Clear Creek, which enters the Otter immediately below Mr. Avery's foundry, west of the village. On the east side of the village another small creek enters the Otter at Mr. Tillson's mill. On this creek is Mr. Green's shingle factory. The gullies of both these creeks are very deep and the descent rapid, and a succession of excellent water powers can thus be formed on each - on Clear Creek there are now the three privileges we have mentioned in operation in less than one mile of its length, with others unoccupied between them."

Some time in the autumn of 1864, Mr. E. D.

Tillson's saw and planing mill was destroyed by fire. On November 24th, 1864, the Observer was able to report:

"Mr. Tillson has already commenced the reconstruction of his saw mill and planing mill, and we understand that he expects to have the planing mill running in about three weeks, and the saw mill about the 1st March next."

And again, on December 8th, 1864:

"The work of recreating the property recently destroyed by fire, proceeds vigorously. The planing mill will be again at work in a few days; and the saw mill is being rebuilt on an enlarged scale and in an improved style, and is expected to be ready by March, or perhaps earlier."

February 23, 1865: "The planing mill has been running for some time past. The muley saw will be working on Monday next /February 27th/, and the circular saws will probably be ready in a short time."

On April 19th, 1866, the Observer presented the following account of the Oxford Woollen Mills:

"These mills, at Tillsonburg, have been recently leased by Mr. James Christie, a thoroughly experienced now in the Woollen business, who learned his trade in Dalkeith and Gallashiels, Scotland, and has worked at it for the past sixteen years in the United States and Canada. Mr. Christie has spent a large sum in putting the machinery in proper working order; and we believe that he will give complete satisfaction to his customers. We are aware that last wool season a great many persons who patronised these Mills were grievously disappointed. But this was owing to the fact that the factory was opened before the machinery was in order, and the press of work afterwards prevented it being put in order until too late. This drawback has now, however, been removed - the machinery is now as perfect as it can be made, and the lessee, Mr. Christie, is one of the best tradesmen in the Country. Therefore we can now confidently recommend the 'Oxford Woollen Mills', at Tillsonburg, to the farmers of Dereham, South Norwich, Bayham, and Middleton."

Mr. E. D. Tillson's advertisement of his grist mill, published in the Observer on June 4th, 1868, supplies some interesting particulars of the character of his operations:

"FARMERS!

"If you want to have your

"G R I S T I N G

"Done in first class style
send your grain to

"E.D. TILLSON'S MILL

"Having just completed a series of important additions, alterations and improvements to the machinery, including a new forty horse-power water wheel, which makes this mill one of the best and most powerful of its kind in the Province, farmers may depend upon getting their work done well and at the time promised. The mill is guaranteed to

"GRIND SIXTY BUSHELS AN HOUR!

"Do not forget that this mill has received the Provincial First Prize for Flour, and also at all the County and Township shows where it has been exhibited.

"Cash paid for all kinds of Grain.

"FLOUR and FEED for sale.

"E.D. Tillson.

"Tilsonburg, May 27, 1868."



In the Historical Atlas of Oxford County, 1876, the plan of the Town of Tillsonburg shows Tillson's saw mill, planing mill, grist mill (all situated on Bloomer Street); his oat meal mill, on Clear Creek, just above its confluence with Otter Creek. A grist mill is shown on Lot 6, Concession XI, Dereham Township, on Clear Creek, on land of J. Smith; this is presumably the "fine new grist mill" of Messrs. J. & M. Smith, of Campbellton. A saw mill is shown on a branch of Clear Creek, just east of Broadway, which may be the one said (in 1863) to belong to Mr. Duncan McLaren. Not otherwise identified is a grist mill, shown on the same plan of Tillsonburg, at the west end of Washington Street, on Clear Creek. A woollen mill on Clear Creek, on the south side of Baldwin Street, said to be the property of a Mr. Waterhouse, may be the same as the one that in 1866 had been "recently leased by Mr. James Christie".

Mills in Houghton

The Historical Atlas of Norfolk County, 1877, in the sentence quoted below, refers to two saw mills in Houghton Township:

"The North Road leaves the Lake Road at the Hemlocks, and running past Safford's and Thos. Forsyth's saw mills, strikes the 'Talbot Street' as it crosses the northern part of the township."

Of Safford's mill no further mention has been found. It is possible that one of those indicated on Lot 9, First Range East of the North Road, was operated by Safford. It is even more likely that many more saw mills were, from time to time, in operation in Houghton Township than those listed here.

1. Lot 9, First Range East of the North Road, on Little Otter Creek, on land of Thomas Forsyth, a mill. Historical Atlas of Norfolk County, 1877, map of Houghton Township.
2. Lot 9, First Range East of the North Road, on Little Otter Creek, on land of M. Adamson, a mill. Historical Atlas of Norfolk County, 1877, map of Houghton Township.
3. Lot 9, Second Range East of North Road, on Little Otter Creek, on land of Thomas Forsyth, a mill. Historical Atlas of Norfolk County, 1877, map of Houghton Township.

4. A road description dated July 28, 1845, includes a sketch, on which is shown "Hardy's Mill" on Lot No. 9, First Range East of North Road, in Houghton Township, on a branch of the Little Otter Creek.
5. The same road description, dated July 28, 1845; the same sketch shows "Francisco's Mill", also on Lot 9, First Range East of North Road, in Houghton Township, on a branch of Little Otter Creek.
6. Lot 18, First Range East of North Road, on Little Otter Creek, on land of Jehu Mosher, a mill: "built south of Garnham's mill, by the Mosher family, who settled about 1850." Historical Atlas of Norfolk County, 1877, map of Houghton Township, and mentioned in the text.
7. Lot 14, Second Range East of North Road, on Little Otter Creek, on land of A. G. Osborne, a mill. Historical Atlas of Norfolk County, 1877, map of Houghton Township.
8. Lot 8, First Range West of North Road, on Little Otter Creek, on land of William Francisco, a saw mill. Historical Atlas of Norfolk County, 1877, map of Houghton Township.
9. Lot 12, Second Range West of North Road, on Little Otter Creek, on land of Benjamin Dighton, a mill. Historical Atlas of Norfolk County, 1877, map of Houghton Township.
10. Lot 139, South of Talbot Road, not on water power, and so presumed to have been a steam saw mill, on land of H. W. Garnham. Historical Atlas of Norfolk County, 1877, map of Houghton Township. The same Atlas adds in the text: "On the (Talbot) street are the Garnham's saw mills." The Historical Atlas of Elgin County, in discussing families residing in Bayham Township, says: "Mrs. Sheriff Garnham, the wife of the enterprising and hospitable proprietor of Garnham's Mills, is a daughter of Nicholas Philips."

Mills in Malahide (Otter Creek Watershed)

1. In the Historical Atlas of Elgin County, 1877, the map of Malahide Township shows a mill on Lot No. 32, Concession V, on a tributary of Otter Creek, on land belonging to H. Pressey. No further identification has been found.
2. Information obtained in 1955, from various sources, indicated a saw mill on Lot No. 30, Concession VI, Malahide Township, on a tributary of Otter Creek known as "South Creek". Name of proprietor, and dates of operation, have not been ascertained.

Mills in Middleton

1. In the Historical Atlas of Norfolk County, 1877, the map of Middleton Township shows two mills, on the northerly end of Lot No. 22, Concession I, South of Talbot Road, near the village of Courtland, not situated on water power, on land belonging to Lot Tisdale. In another place, the same Atlas says: "Courtland now contains 1 saw mill." This fails to explain the two mills shown on the map.

2. The same map in the Atlas shows a mill on the south end of Lot No. 10, Concession I, North of Talbot Road, on a tributary of the East Branch of Otter Creek, on land belonging to Asa Shaver. No further identification has been found.
3. The same map in the Atlas shows a mill on the northerly end of Lot No. 3, Concession II, North of Talbot Road, on the East Branch of Otter Creek, on land belonging to John Ostrander. This is presumed to be the same as the saw mill, known in 1955 as "Saunders' Mill."
4. The same map in the Atlas shows a mill on the north end of Lot No. 6, Concession II, North of Talbot Road, on the East Branch of Otter Creek, on land belonging to Albert Meston. This is presumed to be the same as the flour and grist mill, known in 1955 as the grist mill of Joseph Watson.
5. The same map in the Atlas shows a mill on the south half of Lot 11, Concession II North of Talbot Road, on the East Branch of Otter Creek, on land belonging to Moses Stratton. Information obtained from various sources in 1955 indicated that a flour-and-grist mill at this point, known as Bell's Mill, had been torn down about 1900.
6. The same map in the Atlas shows a mill on the south half of Lot No. 2, Concession IV North of Talbot Road, at the north-west side of the Straffordville-Tillsonburg road (Highway No. 19), on a tributary of Otter Creek, on land belonging to Walter Weekes. According to information obtained in 1955, this was Scanlan's saw mill. The dates of its operation could not be ascertained.
7. The same map in the Atlas shows a mill about the middle of Lot No. 5, Concession IV North of Talbot Road, on a tributary of Otter Creek, on land belonging to James Cowen. This land, in 1955, was the property of Gilbert Hooyer, a tobacco farmer, who had recovered some of the timber from the remains of the dam at this point. The name of the original proprietor, and the dates of operation of the mill, which is presumed to have been a saw mill, could not be ascertained.

Mills in Norwich North

1. The Tillsonburg Observer, June 14, 1866, reported an accident which occurred at the saw mill adjoining the grist mill, at Norwichville. No information as to ownership of the mills is given. Nor can the grist mill of this report be confidently identified with the grist mill of the next paragraph.
2. In the Historical Atlas of Oxford County, 1876, the map of the Townships of North and South Norwich, and the plan of Norwichville, show a grist mill in the village of Norwichville, at a point about six hundred feet south of Main Street, and one hundred feet east of Stover Street. As the mill is represented as being at a distance of more than three hundred feet from the banks of Otter Creek, it seems unlikely that it was operated by water power. The land on which it stood was marked with the name of G. C. Sutton. No further identification has been found.
3. Peter Lossing's map of Norwich Township, 1820, shows a saw mill on the south end of Lot No. 2, Concession V, on the Otter Creek, on land belonging to William Hilliker. No further particulars have been ascertained.

4. Peter Lossing's map of Norwich Township, 1820, also shows a saw mill on the north end of Lot No. 23, Concession III, on a tributary of Otter Creek, on land belonging to John Throckmorton. No further particulars have been ascertained.

Mills in Norwich South

1. Peter Lossing's map of Norwich Township, 1820, shows a saw mill on the north end of Lot No. 2, Concession VII, on the Otter Creek, on land belonging to Solomon Lossing. According to information obtained in 1956 from R.M. Holmes, of Otterville, this mill closed about 1896.
2. Local tradition, for which no authentic confirmation could be obtained, indicates that there was also a saw mill on the north end of Lot No. 3, Concession VII, on the Otter Creek. Dates of operation could not be ascertained.
3. Information obtained in 1956, from R. M. Holmes, of Otterville, indicates that there was a saw mill on the north end of Lot No. 20, Concession VII, on Spitler's Creek, known as Brown's Mills. Dates of operation could not be ascertained.
4. Information obtained in 1956, from R. M. Holmes, of Otterville, indicates that there was a grist mill on the north end of Lot No. 7, Concession VIII, at Milldale. Successive proprietors were Robert Dyak, B. Bowman, McLean & Carlisle, and Duncan McNaughton. The mill closed about 1912. In 1956, almost all trace of this mill had disappeared. In an article contributed to the Norwich Gazette, August 25, 1949, Mrs. G. E. McVittie referred to this mill as the "Old Red Mill", and implied that Duncan McNaughton was the miller from about 1890 until 1900. The Old Red Mill obtained its power from the main stream of Otter Creek. The Historical Atlas of Oxford County, 1877, showed a mill pond at this point, but without the symbol that indicated a mill; the name of W. P. Barker was given as the owner of the land on which the pond lay.
5. Mrs. McVittie is also the authority for the existence of Frederick Watkins' saw mill at Milldale; as her account refers to the industries of Milldale during the 1890's, it seems that Watkins was the proprietor of this mill during that decade.
6. The grist mill at Otterville, built in 1807 by John Earl and Paul Avery, has been mentioned in the section on the history of Otterville; and Treffry's flour and grist mill, on approximately the same site in 1957, is properly the successor to Earl & Avery's mill. Situated on the main stream of Otter Creek, the dam has stood, throughout the duration of this enterprise, on the north side of the road that is Otterville's Main Street (in Concession VIII), while the mill has stood on the south side of the same street (in Concession IX). A plan of the village of Otterville, made in 1854 by John A. Tidey, represents the grist mill at a point just north of Mill Street, and on the west side of the mill race. In the Historical Atlas of Oxford County, 1877, the location of the dam is shown, north of Main Street, but no grist mill is indicated. The grist mill is, however, shown in a sketch of Otterville made by "an amateur", W. Moore, about 1874.

7. Tidey's plan of Otterville, 1854, shows a saw mill on the north side of Main Street, on the west bank of Otter Creek. In precisely the same place, the saw mill is also shown on the plan of Otterville, in the Historical Atlas, 1877. The name of the proprietor, and the dates of operation, apart from the dates of the two plans referred to, have not been ascertained.
8. Tidey's plan of Otterville, 1854, and the Historical Atlas, 1877, both show a woollen factory in Otterville, on the north side of Main Street, and on the east bank of Otter Creek, between the creek and the mill race. No further particulars regarding the woollen mill have been found.
9. Miss Jean Hall Waldie, in an article contributed to the Brantford Expositor, May 11, 1938, states that "Saw and woollen mills were built a little later (than 1845) by the Erbs." The location of the mills referred to is not indicated. No further particulars of these mills have been found.
10. Information obtained in 1956, from R. M. Holmes, of Otterville, indicates that a saw mill was located, before 1876, on the north end of Lot No. 13, Concession IX, on a tributary of Otter Creek. The proprietor was Tom Simmons. No further particulars have been found.
11. R. M. Holmes, of Otterville, has also identified a saw mill located on Lot No. 16, Concession IX, as the property of "Mr. Talbot, a relative of Colonel Thomas Talbot". This mill was on Spitler's Creek. Dates of operation have not been ascertained.
12. Information obtained in 1956, from R. M. Holmes, of Otterville, indicates that there was a saw mill on the south part of Lots 16/17, Concession X, near Cornell. This was the property of John Sutherland. The anonymous writer of a historical account of Cornell refers thus to Sutherland's mill: "John Sutherland built a large saw mill on the banks of the Otter Creek, south of Henry Weaver's farm." Dates of operation have not been ascertained.
13. In operation at the present time (1957), is the flour-and-grist mill of John Rock & Son, on Lot No. 21, Concession XI, of Norwich South Township. Early dates of operation have not been ascertained.

CHAPTER 6.

CHURCHES

As was to be expected, the early settlers in Upper Canada, as in other parts of America, brought their religious affiliations and practices with them to their new homes. The first and most pressing need of each new family of settlers was for a home, a roof over their heads. Before the resources of any religious group were equal to the task of erecting a building to be set apart for the exclusive purpose of a place of worship, the services of the church were held in the homes, in the barns, or, where they were available, in the schools of the community. To such gatherings, as a rule, the people of all faiths and creeds were made welcome.

The Society of Friends, or "Quakers", in the Township of Norwich, held their earliest religious services in 1811 in the home of Peter Lossing, who, in addition to being their leader in business affairs, was also one of their ministers. In 1813, the Society built a frame meeting house on the hill, "where the old burying ground is", and there they worshipped for thirty-four years.

"In the tenth month, 1847, a committee was named by the Norwich monthly meeting of Friends to raise money for the purpose of building a new meeting house.

"On the 14th of tenth month, 1848, the committee told the meeting that they had given attention to the subject but were not ready to report. On the 11th of fourth month, 1849, they reported that they had circulated a subscription generally among Friends and that they had gotten \$710 subscribed. As that was not sufficient to build the house, the same committee was appointed to see what further sums might be raised either by disposing of part of the land belonging to the meeting or otherwise, and to make the necessary arrangements to find and arrange 'with some person who will take the job of building the house or otherwise as the committee may think best, and report next month their progress'.

"Three months later on the 11th of seventh month, 1849, because of the lateness of the season, the meeting decided to build the next spring. They sold nine and a half acres of the land to Isaac Peckham and Samuel Smith, and directed the committee to use the money obtained for the land 'to the building of the meeting house'.

"It was completed before the end of 1850, for, on the 11th of sixth month, 1851, new trustees were appointed to hold the deed of 'the old meeting house lot'.

"Between 1888 and 1890 extensive repairs were made, and the seats arranged as they have been ever since. They formerly faced the north, and there was a partition between the men's side and the women's with wooden shutters, which were left open for meetings for worship, closed for business meetings.

"The four large wooden pillars which support the ceiling were made by John Cohoe, Sr. The pine trees in front and at the road were brought from South Norwich and planted where they now stand (1946), by William B. Stover and John Sutton. The box stove, formerly in the anteroom, was cast in Norwich, and is said to be the first box stove in the township."*

The Quaker Meeting House of 1850 was familiarly known as the "Old Brick". The Stover Street Friends' Meeting House was built about 1890, and became the place of worship of the Orthodox Friends, a group with conservative ideals. The "Old Brick", on Quaker Street, became the place of meeting of the "Young Friends", an organization that separated from the Orthodox parent body at about the time the Stover Street Meeting House was built.

The first Methodist Church in Norwich Township stood on land given by Michael Stover in 1820. The church was built in 1824, though Methodist meetings had been held in the homes of the people since about 1812.

"A new church building was erected in 1862, now Mr. William Penny's machine shop. When all the Methodist bodies united in 1884, the present church was built at a cost of \$15,000, with seating capacity of 750. Subscriptions were given for this by the whole community. This was during the pastorate of Rev. Dr. Williams. The parsonage was built a year or two later."†

The "new church building erected in 1862" may have been a Wesleyan Methodist Church. A Methodist Episcopal Church was built in Norwich in 1877, and in 1885 sold to the Baptist congregation. The date-stone on the present (1957) United Church of Canada, in Norwich, bears the inscription: "Methodist Church, 1885". The first Wesleyan Methodist church in Port Burwell was begun in 1850, completed and dedicated in 1852.

* Excerpts from "The Old Brick (Quaker Meeting House)", in the Norwich Old Home Week Booklet, 1946.

† From the Norwich Old Home Week Booklet, 1946.

"According to church records, the first church was a frame building, and erected upon the site of the present (1930) commodious brick church, which was built in 1910. The frame church was built under the direction of Mr. George Backhouse, a local preacher and class leader of the Wesleyan Methodist church. The lumber and material were largely donated by owners of the sawmills located in the surrounding district, and large donations in labor were also made. The building fund was raised by various methods, subscriptions, tea meetings, and also through the efforts of the Ladies' Sewing Society. One of the largest tea meetings ever held in the Port, when over 500 attended, was held in the old Baptist church, then located on the Gravel Road, near the old Baptist cemetery on the hill north of the village, the proceeds of which were devoted to the building of the new Methodist church."*

The Methodist body known as the New Connexion Methodists had their own church in Tillsonburg in 1868, which they placed at the disposal of the Church of England minister and congregation, who at that date had not yet built one for their own use. As early as 1864, services of the Church of England in Tillsonburg had been held in the Presbyterian Church.

The United Church of Canada, in Otterville, was formerly the Methodist Church of that village, originally built in 1884. The Methodist Church in Burgessville, was built in 1899.

According to the Port Burwell Centennial Book, 1930, the Baptist Church in that village was established in 1819. The following passage is taken from the original minute-book:

"A number of Baptist brethren living in the Township of Bayham, in the County of Middlesex, in the District of London and Province of Upper Canada, met together at the house of Dennis Downlands to consult together the better how to keep up the visibility of Christ's Kingdom."

The present (1957) Baptist Church at Port Burwell was built in 1865, and dedicated on December 17, of that year.

The Baptist Church at Springford was organized at a meeting held on October 6, 1832, in "the old block school-house", just west of the village. Mr. Jesse Woodard was the

* Port Burwell Centennial Souvenir Book, 1930.



Otter Valley Baptist Church, East of Vienna, Lot 22, Con. 11. This church was torn down in 1938 after about 100 years of use.



Edison Family Burial Ground, near Vienna. Acquired by the Otter Creek Authority in 1955. The grandparents of Thomas Edison are buried here with other members of the family. Samuel Edison, the inventor's father, fled to the United States after the Rebellion of 1837.

first clerk; and Elder Nichol French was the first pastor, serving from 1832 until 1837. For the first ten years of their organization, they worshipped in the school-house; in 1842 they were able to give up the meetings in the school-house and were found worshipping in their own chapel. In 1844, their membership numbered fifty-eight. The statistics of 1861 showed a membership of 108 in that year. In 1881 the property adjacent to the church was acquired for use as a parsonage. Between 1886 and 1889 the present brick structure was built and dedicated. The first hundred years of the Springford Baptist Church (1832 - 1932) was marked by thirty-two pastorates; and the church report of the centennial year showed a total of seventy-five members.*

The Baptists in Norwich Village first organized in 1884, under the leadership of the Rev. H. Woodward. They had sixteen charter members. In 1885 they bought the former Methodist Episcopal Church building. Their parsonage was the historic John McKee home on Elgin Street.

An announcement published in the Tillsonburg Observer, January 26, 1865, reads:

"The new Free-Will Baptist Church at Dereham Centre will be dedicated to the worship of God on Sabbath, 5th February next."

Toward the end of May, in 1958, the Otterville Baptist Church will celebrate its hundredth anniversary. In 1949, when the congregation was ninety-one years old, a brief résumé of its history was prepared.

"In 1858 Rev. William Haviland, then pastor of Burgessville, held evangelistic meetings in the town hall at Otterville. Following the special meetings, a church was organized with Rev. William Haviland as pastor, and Stephen Delong and Silas Slaght as deacons, and Edmund Titus church clerk.

"In 1865 a site was procured and a church building erected. At that time, the cause at Otterville was maintained in connection with the Springford church, until 1874, when the church was reorganized.....

* Extracted from "Historical sketch of Springford Baptist Church on the occasion of its One-Hundredth Birthday, 1932".

"About 1882 the little flock passed through a season of anxiety and discouragement. The grouping of the surrounding churches was such that the Otterville church was left by itself, and being unable to support a pastor alone, services for the congregation were suspended.....

"The original church building has been furnished with a large cheery basement. The auditorium has been furnished with new seats and many other improvements. The exterior has been veneered with red brick, and the roof has been renewed. Also a large concrete shed was erected and later sold to the township."*

The legend on the notice-board at the Otterville church reads: "Otterville Fellowship Baptist Church", and the date-stone bears only the date: 1904.

The Presbyterians in Tillsonburg were an established congregation with a building of their own, when, in 1864, they made their church available for a service of the Church of England. On September 8, 1864, the Tillsonburg Observer announced:

"that Benj. Cronyn, D.D., Lord Bishop of the Diocese of Huron, will (D.V.) preach in the Presbyterian Church, Tillsonburg, on the evening of Tuesday, 20th inst., at half-past six o'clock; after which he will hold a Confirmation Service."

A similar announcement in 1865 shows that the use by the Church of England of the Presbyterian Church building was still continuing. Thus again the Observer, July 13, 1865:

"Services (of the Church of England) will be held on Sabbath, 16th, in St. Charles' Church (Dereham Township) at 10 o'clock in the forenoon, and in the Presbyterian Church, Tillsonburg, at 3 o'clock in the afternoon."

On Friday, March 23, 1866, the Presbyterians of Tillsonburg gathered at the home of the pastor, the Rev. Mr. Richardson, to present him with a gift as a token of their esteem.

In Norwich, the Presbyterian Church was first established in 1849, when a frame building, situated on John Street, was dedicated to the worship of God.

"They became an independent congregation in 1852. In 1879, during the pastorage of Rev. William Martin, their present church was built on Main Street."†

The earliest activities of the Roman Catholic Church in the Otter Creek Watershed were the labours of the

* Clipping from an unidentified newspaper, June 2, 1949, in possession of Mrs. R. M. Holmes, Otterville.

† Norwich Old Home Week Booklet, 1946.

Jesuit, Recollet, and Sulpician missionaries who visited here in the Seventeenth and Eighteenth Centuries; neither their zeal nor their tireless devotion could stay the wars of extermination by which their converts among the Neutral Indians were destroyed or dispersed, and their work brought to an end.

When, in the early Nineteenth Century, under British rule, white settlers began to people the townships of the watershed, not many of these were of the Roman Catholic faith. It was not until the 1840's, when emigration from Ireland on a large scale resulted from the political and economic conditions in that country, that any considerable numbers of Irish Roman Catholics found their way into Canada West, and brought with them the need for the services of their church.

It has been noted in an earlier chapter that one of the grantees of a large block of land in the Township of Norwich was the Reverend Edmund Burke. Father Burke was of the Roman Catholic faith, and is described in the Patents as "the Rev'd Edmund Burke, of Halifax, Nova Scotia, Priest." His Patent of September 4, 1800, was for 3,000 acres: and a second Patent, dated March 15, 1804, was for 1,200 acres. Ultimately all these lots were sold to actual settlers, and it does not appear that they became the homes of people of either Catholic or Protestant religion exclusively.

Among the Catholic families that settled in Norwich were the McNallys, the Furlongs, the Sheahans and the Duffys. St. Peter's Church, in Norwich North Township, "was erected in 1894 on the site of the earliest structure, a hand-hewn frame church built in 1853, on land donated by the McNally family. In 1944 the church celebrated its golden jubilee. For some 30 years before the original church was built, the early pioneers went to Beachville and other neighbouring churches, or when a visiting priest came to the community, they would meet in one of the homes."* At one

* Norwich Old Home Week Booklet, 1946.

time this congregation had a resident pastor, but at other times has been part of the charge of the incumbent at Ingersoll, Woodstock, or Tillsonburg.

At one time, in the 1850's, an effort was made to establish a Congregational Church in the village of Norwich. A small building on the east side of Stover Street North was fitted up in which to hold service, and Reverend Solomon Snyder became pastor. This denomination continued for about one year, and then its members united with the Presbyterians.

It has been pointed out that one of the contributions that Colonel Mahlon Burwell made to the early life of Port Burwell was the building and endowing of a Church of England in that village. On April 12, 1836, Colonel Burwell wrote to Dr. John Strachan, then Archdeacon of York, to invite him to preach the first sermon in the new church.

"My dear Archdeacon,

It is a good while since I have troubled you with a line, but my Church at Port Burwell is now in a State to be Preached in, you promised me that you would preach first in it, & I must hold you to your word. After you have preached in it, the Rev'd. Mr. Evans /resident at the Village of Simcoe/, and others of our Church can Preach there occasionally, and until we can get a resident Clergyman. The Church has already cost me a good deal, and I shall put myself to considerable more expense in completing it to my mind, & between ourselves, I intend to do that which I am not aware of any other persons having done in the Province - I intend making a Deed for the Church and about 5 Acres of Ground adjoining it, in which is a beautiful spring brook, & site for a Parsonage House, and I shall seek no remuneration. I shall only reserve a Pew for myself and my heirs, and make the Deed for the uses of the Established Church in this Province, but am not determined whether I will make it to the King, or to the Bishop I do not wish any allusion to be made to me, or the manner in which the church has been built."*

The sermon was preached on Sunday, May 22, 1836.

On that occasion, the "Magistrates and Inhabitants of the Village of Port Burwell, and its vicinity" presented to Archdeacon Strachan an illuminated address to thank him for his part in setting forward the work of the Church of England in their community. To the conventional expression of their

* Ontario Archives, Strachan Papers: April 1836.

thanks and appreciation, Colonel Burwell added a second paragraph, the wording of which had been proposed by Dr. Strachan himself:

"We take this occasion to express our earnest hope, that strangely overlooked as you have recently been to the deep regret of every enlightened mind in both Canadas, you may yet live to be promoted to that Professional Station which you are so well qualified to adorn, and to which you have long had the first claim; and happy will it be for the prosperity and rapid extension of the Church, and the moral elevation of this Province. Be assured, Venerable Sir, that our sincere wish is, that you may be blessed with many years of Health; and that your decline of life may be accompanied with that peace and happiness which it is natural to hope, and expect, will follow the exercise of that fearless adherence to truth and justice, by which your life has been eminently distinguished."*

Of the sixty-seven Magistrates and Inhabitants who joined with Colonel Burwell in signing this remarkable address, it is doubtful whether any ever guessed the source of the sentiments it expressed, or had the smallest suspicion that they were other than spontaneous! Three years later, August 4, 1839, the Venerable Archdeacon was consecrated Bishop.

In the year 1836, from February to October, the townships bordering on the Otter Creek were part of the territory to which the Reverend Thomas Green was assigned as Traveling Missionary. Green's journal of that year contains many references to places and people in the watershed, and shows that he maintained more or less regular services in Vienna, Port Burwell, Middleton (now Courtland), Norwich Township and Norwichville, and in the Townships of Windham and Malahide; on one occasion he records a visit to Dereham, but does not identify the precise locality. He names the people in whose homes he was entertained, who assisted, sometimes at short notice, in assembling the scattered congregations, and who opened their homes for the holding of a church service. These may be identified as follows.

* Both Dr. Strachan's draft of his proposed "conclusion of the address", and the finished address, done on parchment, with the signatures attached, are preserved in the Strachan Papers, in the Ontario Archives. In only two words do they differ: Burwell inserted the word "to" in "adherence to truth and justice", where Strachan had inadvertently omitted it; and Burwell omitted "so" from the concluding line where Strachan had written it, "has been so eminently distinguished".

At "Dereham" (Tillsonburg)		Mr. Stroud Mr. Burn
At Vienna	-	Mr. Isaac Draper, J.P. Mr. John Wright Mr. Ault
At Port Burwell	-	Mr. John Burwell, J.P.
At Middleton (Courtland)		Mr. Lot Tisdale Mrs. Tims Mr. John M. Crawford Mr. Standings
At Windham	-	Mr. Robins
In Norwich Township	-	Mr. Davis Mr. Robinson
At Norwich Lower Settlement (Otterville)		Mr. Addison
At Norwich-ville	-	Mr. Houseman

The following passages will serve to show the character of the Travelling Missionary's work.

"After morning service at Norwich (date not given), accompanied by a friend to direct me, I set off for the township of Dereham; our route lay through a thick forest of pines, and our ride, though lonely, was not unpleasing. When we reached Dereham it was nearly dark, and unhappily I soon found that the 'notice' which I had sent out some days before, had through some mistake, never reached: our arrival therefore was wholly unexpected. We first stopped at the house of a Mr. Stroud, but being in the hands of workmen, he could not take us in; he took us, however, at once to a neighbour, Mr. Burn, who gave us a most cordial reception; and as soon as we made known the purport of our visit, he borrowed my friend's horse, and sent his son to apprise the families in the neighbourhood: and I was not less surprised than pleased to perceive that notwithstanding the hurry of the notice, and the lateness of the hour of appointment (eight o'clock), as also the darkness of the night, from forty to fifty assembled."*

"Saturday 20th February 1836. I went forward to Vienna and was most kindly received by Mr. Draper, an attached member of the Church, and in the evening I lectured at his house.

"Sunday 21st. Mr. Draper having kindly provided me a horse and cutter, I proceeded at an early hour to Port Burwell, situated on Lake Erie. Mr. Burwell, a brother of the proprietor of the place, received me very cordially, and immediately made an arrangement for holding the morning service in the large room of a tavern, the only place of convenient size which could be procured. I was the first minister who ever performed divine service in the place, as neither Methodist nor Baptist preacher has ever attempted to establish a congregation here. Immediately after the service I returned to the village of

* Waddilove, Rev. W.J.D. The Stewart Missions. London, 1838. Page 158.

Vienna. It is most beautifully situated on Otter Creek, affording many advantages to the enterprising emigrant from its vicinity to the Lake, being distant only three miles. I slept at Mr. Draper's.

"Monday 22nd. After morning prayers with the family, I set off on my way to Middleton, and had a tedious drive, rendered more disagreeable by a sudden thaw. I arrived at the house of a Mr. Tisdale, the son of an American gentleman who settled in this country at the time of the revolution of the United States. As there is no School-house convenient, he gladly gives me the use of his house; a small congregation, some of whom came many miles, attended. This neighbourhood is occasionally visited by Methodist and Baptist Ministers."*

"Saturday 9th April 1836. I was obliged by an appointment to set out for Windham (from Simcoe) this morning. After travelling very slowly, the horse nearly up to the knees every step, the bridges and causeways all covered with water, in consequence of the heavy rain, I at last reached my destination, and was kindly received by Mr. Robins.

"Sunday 10th. I read the morning service and preached in the school-house, and although the day was so extremely unfavourable, a large congregation were assembled. I then rode back to Simcoe."†

"Thursday 16th June 1836. I proceeded (from Brantford) to Blomfield, and in my way stopped at Mr. Tinley's, and after a short rest, went on to the house of Mr. De Meys, where I read prayers and preached to a small congregation.

"Friday 17th. I set off for Middleton, and had scarcely passed through the long woods, (about eleven miles) a weary drive, the whole one vast forest of pines, and no vestige of house or cultivation, when an awful and terribly sublime thunder storm came on. The frequent and vivid flashes of forked lightning, accompanied by long and heavy peals of thunder, surpassed any thing I had ever seen or heard. This storm fully realized to my mind those described as occurring in eastern countries; it continued for nearly two hours. The rain fell in torrents all the time, several trees were struck with the electric fluid, and one quite close to the house at which I had found shelter from the pitiless storm. When it somewhat abated, I proceeded on my journey to the house of Mr. Tisdale, where I was kindly taken in for the night."**

"Thursday 8th July 1836. I rode (from Burford) to Norwich, a long and dreary ride, in which I experienced great difficulty in making my way through the pine woods. I suffered much inconvenience and many privations in this journey.

"Friday 9th. I then rode to Middleton, through a dreary pine wood, which seemed in some places to shut out almost every ray of light. I preached in the school house on Talbot Street, and passed the night at the house of a

* Waddilove, op. cit. Page 184.

† Waddilove, op. cit. Page 191.

** Waddilove, op. cit. Page 197.

member of the Methodist Connexion, where I read and expounded in the evening.

"Saturday 10th. I rode forward to Vienna, in the township of Bayham. On my road I visited some scattered families, and passed the night at the house of Mr. Draper."*

"Wednesday 27th July 1836. I again left Woodhouse to go to Norwich, and reached Middleton.

"Thursday 28th. I left Middleton for Norwich, where I read prayers and lectured upon the Church service and preached. My congregation assembled in a large room, and consisted of all sorts, Methodists, Quakers, and two Roman Catholics."†

"Thursday 9th September 1836. I rode (from Woodhouse) to the township of Norwich and stopped at the house of Mr. Addison.

"Friday 10th. Leaving the house of Mr. Addison, I proceeded to the school house, a short distance from his residence, and preached at ten o'clock to a small congregation. Immediately after the service, I set out for the township of Middleton, having an appointment at four o'clock. After prayer and preaching I accompanied Mr. Tisdale, who has shown me the most uniform kindness since the first commencement of My Mission.

"Saturday 11th. I set out for Vienna, and being caught by a very heavy storm of rain, I was compelled to discontinue my journey. I stopped at the house of Mr. Standing, from England, he is a Congregationalist."**

"Monday 25th September 1836. I rode (from Burford) to the township of Norwich, and stopped at the house of Mr. Davis.

"Tuesday 26th. I read prayers and preached to a large congregation of a very mixed composition, Methodists, Baptists, Quakers, and Church people.

"Wednesday 27th. I rode to Norwich-ville, and visited a family of the name of Houseman.

Thursday 28th. I proceeded to the lower Settlement of Norwich, and preached in the school-house. Congregation not large. My route this day very dull and dreary, and from the wetness of the late weather travelling had become very unpleasant. I lectured in the evening at Mr. Addison's."††

The efforts of Colonel Burwell to complete the building of the church at Port Burwell were not rewarded with immediate success. In February, 1837, the Reverend Thomas Green wrote that "Colonel Burwell has nearly finished the

* Waddilove, op. cit. Page 200

† Waddilove, op. cit. Page 202

** Waddilove, op. cit. Page 205

†† Waddilove, op. cit. Page 206

building of a Church at Port Burwell." In a letter dated November 23, 1837, Green wrote:

"Colonel Burwell has got the Church at the Port plastered. He has also set apart a neat and comfortable house, for the residence of a minister, and has endowed the Church, from his own property, very liberally with lands."*

In 1848, the Reverend A. N. Bethune, newly appointed Archdeacon of York, made an official visitation to all the parishes in the vast Diocese of Toronto, which then included all of the peninsula embraced by Lakes Ontario, Erie, and Huron. Bethune's report was dated September 25, 1848:

"On the following morning, Saturday April 29, we proceeded to Port Burwell, and at 4 p.m. adjourned to Trinity Church. This, - like the place generally - has a desolate look, having never been painted & being considerably out of repair. The people in the immediate neighbourhood, & who properly form this congregation, being poor, not much can be expected from them; the Church itself had been built at the expense of the late Colonel Burwell. There is a portion of it laid out in Pews. Through the liberality of Colonel Burwell, a commodious parsonage-house has been provided, which Mr. Read, the Incumbent, finds very comfortable. It is not yet painted, but he thinks he can obtain from the parishioners what will enable him to effect this improvement. By Colonel Burwell, the munificent endowment of 600 acres of land has also been annexed to the Church at this place; but at present it makes no return whatever, not even so much as will pay the annual taxes. It is stated that 200 acres of this endowment could be turned to some account, being situated within a mile of the Village; but the immediate prospect of any such advantage depends, in a great degree, upon the carrying out the projected improvements in the Harbour, - an advantage, it is apprehended, which is not now very near at hand. I advised the insurance of the Church without delay."

"The following day, Sunday April 30, I preached at Vienna, a village about four miles up the river which empties itself in to Lake Erie at Port Burwell. The Congregation was quite large. Here a neat Church was nearly ready for Divine Service. As Vienna is a thriving village, it promises to be an important station; & even now it is much the most satisfactory point at which Mr. Read officiates."†

The Archdeacon next visited St. Charles' Church, Dereham Township, which stood then, as its successor church stands in 1957, on a plot of ground taken from the north ends of Lots No. 1 and 2, in the Ninth Concession of the township.

* Waddilove, op. cit. Page 177.

† Ontario Archives, Strachan Papers: September 1848.

These lots had been originally granted to the Reverend Robert Addison; in 1876, Lot 1 was the property of John Burns, and Lot 2, the property of Joseph Wardle. The church stands astride the side-line between them.

"On Tuesday morning, May 2, after an early breakfast, we left the hospitable house of Mr. Doby /Lot 15, Con X, of Bayham Township/, and proceeded to the Church in Dereham, where service had been appointed for 10 o'clock. This Church is most pleasingly situated on a little eminence, and is a very attractive object on emerging from the woods, especially as it is a neat structure painted white, and with a very Church-like appearance throughout. It is called St. Charles, in memory of the late excellent Bishop Stewart, to whom a handsome marble slab is erected within. The whole Church, indeed, may be considered as a memorial of the departed prelate, as it was built almost entirely from funds collected by the Rev. Mr. Waddilove in England. All that the people were called upon to contribute was a little in labour, while the building was in progress; and at the time very few in the neighbourhood were in circumstances to do more An endowment of 4 acres has been annexed to this Church, the gift of two individuals

"We could not leave Dereham without partaking of some refreshment at Mr. Burns's, a very intelligent & zealous member of the Church who lives in the immediate neighbourhood. These acts of hospitality, though most kindly meant, generally create inconvenient delay"

In 1865, the Church of England congregation in Tillsonburg still constituted a "mission", and had no church edifice of their own. In that year, the Reverend E. Peake was appointed to succeed the Reverend Andrew Fisher in the charge of that mission, as well as in charge of St. Charles' Church, Dereham, and the congregations at Otterville and Norwichville. In February, 1867, the first step was taken toward organizing an independent parish; on the 21st of that month, the following advertisement appeared in the Tillsonburg Observer.

"At a preliminary meeting held here for the purpose of considering the propriety of establishing Episcopalian Service in this place, it was resolved, to invite all friends of the Church of England to attend a

MEETING IN THE SONS' HALL, TILLSONBURG

on Saturday 16th March

next, at two o'clock, p.m.

To decide on the best means to be adopted for that purpose."

* Ontario Archives, Strachan Papers: September 1848.

The first Vestry Meeting was held on June 27, 1867, when Dr. Tweedale and Mr. F. R. Hawkins were elected wardens, and Mr. John Tibbs, vestry clerk. The Reverend W. H. Jones had succeeded Mr. Peake, and presided at the vestry meeting. Under their new leadership, the congregation set about the building of a church, which was "opened for divine service for the first time" on Sunday, June 7, 1868 and "formally opened, with appropriate services by the Lord Bishop of the diocese", on Sunday July 12th. "Crowds attended these interesting services, and the church (which is a tasteful erection in the gothic style) was very much admired."*

* Tillsonburg Observer, July 16, 1868.

CHAPTER 7

REBELLION OF 1837

"The rebellion of 1837 caused great excitement"

The writers of local history and personal reminiscences in the course of the past hundred and twenty years make frequent reference to the troubled events of that fateful year, in which an armed rebellion in the Provinces of Upper and Lower Canada almost succeeded. The following passages are taken from the Norwich Old Home Week Booklet, 1946.

"At the time of the Rebellion he (Dr. Ephraim Cook) helped Dr. Duncombe in every way he could and was sought after at once by McNabb's men. Many years later Moses Mott told one of his family how he took Dr. Cook out of the township in a load of hay."

"In 1837 he (John Tidey) joined Dr. Cook and the other rebels, was taken prisoner, and lodged finally in the Hamilton jail. Miss Poldon gleaned from his diary the story of the sufferings of the captives: 'Discomfort, filth and vermin, and bad food broke their morale and their health..... Petitions were sent in, wives interviewed members of the Legislature, taking long journeys, sometimes walking.' Mrs. Tidey went to Hamilton to plead for her husband, her family being looked after by her neighbours while she was away. Finally, Mr. Tidey was released, and soon afterwards moved with his family into the growing village of Norwichville."

The events in Upper Canada which led up to the outbreak of armed rebellion were the reflection of an irreconcilable difference of opinion between the Government (the Lieutenant-Governor and the Executive Council) on the one hand, and the elected representatives of the people (the House of Commons Assembly, or Legislative Assembly) on the other. The Governor and his Council held office by appointment; and they held in abhorrence the thought that their offices should be filled by election. The policies and practices by which the newly-constituted United States were governed were to these gentlemen the antithesis of good order; "republicanism" was the abominable device of "democratical Scoundrels".* The

* In a letter from the surveyor William Chewett to the Surveyor-General, dated January 1, 1798, the writer discusses the claims of an applicant from Lower Canada to lands in Cornwall Township, and describes the applicant as "this democratical French Canadian Scoundrel".

members of the Legislative Assembly were elected; and, in a way they were not prepared exactly to define, they looked for some measure by which the Government would be responsible to them, as they, in turn, were responsible to those who had elected them. In March, 1831, the Legislative Assembly presented a long list of grievances to the Government; and the Executive Council resented the "interference". On other occasions, the Assembly sought to control the business of the province, to manage its revenues and expenditures, to pass upon the merits of proposed appointments, and to examine from time to time the "state of the Province".

The appointment in 1836 of Sir Francis Bond Head as Lieutenant-Governor of Upper Canada widened the breach between the Tories and the Reformers. Sir Francis denied to the Executive Council the right to be consulted by him on matters of public business, and announced that the Council existed only for his convenience, and "to confer dignity upon his proceedings".

William Lyon Mackenzie was the acknowledged leader of the Reformers.

"The prosecutions and persecutions to which William Lyon Mackenzie was subjected, in and out of parliament, contributed during this period not only to build up that gentleman's popularity and influence, but to still further embitter a considerable portion of the population of the province against the government. Mackenzie wielded so caustic a pen and so aroused the ire of the official party by his bitter writings that a band of young hotheads conceived and carried out the mad project of breaking into the printing office where his Colonial Advocate was published and casting a portion of its contents into the bay. This, though intended as a crushing blow to Mackenzie, proved just the reverse"

"Head was repeatedly warned from the most reliable sources that preparations for a rising were taking place. The ablest of Canadian Methodist ministers, the Rev. Egerton Ryerson, with a brother clergyman, warned Attorney-General Hagerman of the incessant drillings and patrollings going on in that part of York County in which they had lately been ministering. Captain Fitzgibbon warned Judge Jones of the pike-heads and handles being distributed at Markham, and got snubbed for his over-officious zeal. Besotted in their self-conceit, Head and his Government would accept no advice, nor take any precaution."

* Ermatinger, C.O. The Talbot Regime. St. Thomas, 1904. Page 191.

† History of Toronto and County of York. Toronto, 1885. Page 167.

The leader of the Reformers in the London District was Dr. Charles Duncombe.

"Dr. Charles Duncombe came from Delaware county, New York, to St. Thomas, followed at short intervals by his aged father, Thomas Duncombe, his mother, Rhoda Tyrell Duncombe, and his youngest brother, Dr. David Duncombe; and they were joined, upon the death of the father in 1822, by the second son, Elijah, also a doctor. In fact the Duncombes of this family have been almost exclusively medical men from that day to the present. Charles left St. Thomas and settled at Burford, in Oxford, about the time of his father's death, and his brother David made his home at Waterford, in the county of Norfolk. Dr. Charles Duncombe is described as a handsome man, somewhat small of stature, but of pleasing and dignified appearance, much esteemed by those among whom he practised his profession, and a forcible speaker,"*

Another account says of him:

"Duncombe was a many-sided man, a lucid and impressive speaker, well read in history and general literature, and gifted with a personal magnetism which enabled him to exert no slight influence over the farmers of the sections of five or six counties into which his practice extended. He had been for many years representative in the Assembly of the riding in which he lived Duncombe had acquired considerable wealth in the course of his practice, and owned much land in Brant and Oxford."†

In the Township of Norwich, in December 1837, Dr. Duncombe had assembled an "army" of some two hundred men; and while the issue of the Rebellion was being settled, and the rebels were being dispersed, at Montgomery's Tavern, north of Toronto, Duncombe was on the march, on his way to join Mackenzie, and expecting that his small force would be swelled as he proceeded. On his arrival at the village of Scotland, half way between Norwich and Brantford, Duncombe learned of the defeat of Mackenzie and of the near approach of a Government force under the command of Colonel McNab. By December 13th, a week after the encounter at Montgomery's Tavern, the Middlesex Militia, under the command of Colonel John B. Askin, Clerk of the Peace at London, was on its way to join Colonel McNab. As these western volunteers approached the village of Scotland, they expected to be met with resistance from Dr.

* Ermatinger, C.O. The Talbot Regime. St. Thomas, 1904. Page 194.

† History of Toronto and County of York, Toronto, 1885. Page 163.

Duncombe. Instead they found McNab in occupation of the village. Duncombe had recognized the hopelessness of the situation, and had ordered his army to disperse.

In spite of their hasty dispersal, many of the rebels were overtaken and taken prisoner by the Government troops. About forty of them were captured at the bridge where the Talbot Road crosses the Otter Creek, near the village of Richmond (Bayham Post Office). Dr. Duncombe made his escape to the United States.

Colonel McNab's army was quartered for a year in the vicinity of Norwich. For some months the arrest of alleged and suspected rebels continued, and the trials for sedition and for treason dragged on for a long time. Considerable numbers of persons who believed themselves innocent of any such crimes took occasion quietly to avoid the risk of arrest, imprisonment, and trial, by slipping across the border into the United States, some intending to return, others to make for themselves a new home in that country. One of those who went thus into voluntary exile was Samuel Edison, of Vienna.

The Edisons, descendants of a Dutch family, had, in 1730, settled in New Jersey, where they established themselves as bankers, and were possessed of considerable property. During the American Revolution, John Edison remained a loyal British supporter, and for that reason his fine home was burnt and his broad lands were confiscated. In 1783, he and his family were among the first to be transported to Nova Scotia, where he made himself a new home on the shores of the Bay of Fundy, near where Digby now stands. Through the influence of Colonel Thomas Talbot, John Edison, now well on in years, left his lands in Nova Scotia, and came in 1811 to settle at the site of Vienna. Samuel Edison was his grandson.

"Samuel Edison was an ardent admirer of William Lyon Mackenzie, he detested the Family Compact, and when

1837 came he sympathized with the rebels. Just what part he took in the proceedings of the rebellion is not known, but at any rate, when the soldiers came around the Vienna district arresting the rebels following Mackenzie's failure, Edison learnt that his name was included in the 'black list'. It was the middle of winter, and Edison, a hunted rebel, was forced to flee from the country and the home he loved. A bounty of \$500 was placed on his head, but after a long tedious march on foot and alone he reached Sarnia without being discovered. At Sarnia he considered himself quite safe and did not hasten to cross into the United States until one day shortly after his arrival there a friend whom he had known in Vienna met him on the street. The friend wanted to talk, but Edison got away from him as rapidly as possible and, not knowing whether to trust him or not, he set out immediately on the hazardous crossing of the ice of the St. Clair River. His wanderings took him to Ohio, and the following year his wife and family left Vienna and joined him. At Milan, Ohio, in 1847, Thomas Alva Edison was born,"*

* Tillsonburg News, May 2, 1940.

CHAPTER 8

TRANSPORTATION

1. Roads

Before the days of recorded history in the Otter Creek Watershed, the natural travel routes were the streams and lakes; and through long usage there were added to these the man-made trails and portages of the Indians. As these had served the needs of the aborigines in their wars and in their hunting, so they also served as channels of access by which missionaries, explorers, surveyors, and pioneer settlers came into the wilderness.

When settlement began, one of the first requirements of the pioneers was an improvement in the means of communication. In laying out the townships, the surveyors were instructed to provide allowances for roads, generally one chain (66 feet) in width, along the township boundaries, along the "front" of each concession, and along the side-lines between every fifth and sixth lot. When, following such a survey, the settlers arrived to occupy their lots, they found the "road" consisting of a line of blazed trees through the forest. It was an important part of their "settlement duty" to clear half the width of the road allowance in front of their respective lots; and when they had done so, and all their neighbours had done the same, the road was "opened", but not yet improved. They now had at least an opening through the woods, more or less along a straight line, by which they could find their way on foot or on horseback from place to place, but without much of either ease or comfort. To cut the stumps of large trees down to ground level, or to such a height as would permit a vehicle to pass over the tops of them; to bridge the streams and causeway the swamps; to cut down the tops and fill the bottoms of the steepest grades - these were tasks to engage the attention of the Government, the appropriation of a

large share of the public moneys, and the labour of the inhabitants in every part of the province.

The Talbot Road was intended to provide convenient communication between Talbot's Settlement and the seat of government at York (Toronto), and also to attract settlers along its extent whose duties would include the clearing of the road and making it passable for vehicles. This in turn would enhance the value of adjacent lots in the townships through which the road would pass, and make for more rapid and more compact settlement. The Talbot Road was not to follow a fixed course, like a township boundary or a concession line, but was to be adapted to the conditions of the topography, to avoid the swamps and the hills, and to effect a workable compromise between directness of line and the most "eligible" ground. This involved a good deal of exploratory surveying before the course of the road was finally determined; the surveyor, Mahlon Burwell, writing on the 4th of December, 1809, thus reports his "operation" in laying out the Talbot Road.

"Generally speaking of my operation thro' the Townships of Southwold, Yarmouth, Houghton [which included the present Malahide and Bayham], and . . . Middleton, I flatter myself I have pursued the best method - in laying the Road thro' Southwold, and from where I commenced on the line between it and the Township of Dunwich, I found it necessary to make two courses, as you see by the Plan; if I had gone in a direct line, the Road must have crossed a considerable of Swamp & would have made the distance but little less than at present; and to have gone further to the North West with the whole operation, so as to make a straight Line, would cross broken Land, & probably interfere with the Land already conceded on the River Thames. The Line between the eighth & ninth Concessions of Yarmouth, is perfectly elligible for a Road to be made throughout, with very little expence to the Settlers, as you will see by the Plan, so that I lost, or occupied, but little time in that Township, having only to repost & reblaze the Line. Through the Township of Houghton, I found it necessary to make a great Number of turns, on account of Swamps, Gullies &c., which intercepted the way; the Field Book and Diary I think contain sufficient reasons for the operation.

"The Land in Southwold, Yarmouth & the West part of Houghton, is exceedingly good along the Road,

"but towards the Eastern limit of Houghton, it is considerably interspersed with Marshes & Swamps."*

The earliest "improvement" of the roads was generally limited to the most necessary grading, the use of corduroy or other causewaying across the swamps, and the construction of bridges across the streams. The roads thus improved were still subject to seasonal hazards. They were at their best in summer weather and when, in winter, they were covered with enough snow to make good sleighing. A common experience was that of the Rev. Thomas Green, already several times quoted, who wrote in his journal of October 13, 1836: "The roads were deep, and the travelling very disagreeable, from the incessant rains". The spring thaw generally put a stop to all travel: a report of the Post Office Department, dated December 8, 1828, refers to the condition of the roads and bridges that the couriers had to travel:

"I do not mean to say that these roads throughout their whole extent are bad; but there are portions of them from ten to twenty miles together, which, at certain periods of the year, are almost impracticable; so much so, that I am astonished how the couriers get through. . . . I shall experience great difficulty in forming a new contract when the present one expires, except the roads are placed in a better condition."†

By a variety of practices, introduced from time to time on an experimental basis, the roads were gradually still further improved. There came into use the gravel road, the Macadamized road, and the plank road. The following passages are taken from a report submitted in 1831 to the House of Assembly by a committee on roads in the Home District; most of the report is equally applicable to conditions to be found in other parts of the province. The chairman of the committee was William Lyon Mackenzie.

* Survey Records, Department of Lands & Forests. Surveyors' Letters, Vol. 13: No. 5.

† Journal of Assembly of Upper Canada, 1829. Report of T.A. Stayner, Deputy Post Master General, at Quebec.

"Perhaps the greatest thoroughfare leading from York, is Yonge Street. It might be worth while at some period not far distant, as an experiment, to allow a sum sufficient to macadamize four miles of that road to be expended and afterwards to place a toll bar with moderate rates of toll for 2 years, within a mile of York, the toll to be let by auction, and the proceeds to be applied to keep the road in repair."

"It seems expedient that a special provision should be made out of the district funds to pay three steady faithful laborers, one of them to be employed continually on Yonge Street, and the other two on Dundas Street, East and West, to fill up bad places and otherwise keep in repair the worst places on these roads."

"The common manner of road-making here, is to break up the foundation of the road to a great depth with a plough, and thus it is brought into the worst possible state for a foundation; the road is then made into a convex curve so flat in the middle that the water lodges, softens the road, renders it liable to form ruts, while it is so steep near the sides that a carriage approaching them is in danger of upsetting. Such a road, and more especially when large stones are put into it and covered up with gravel, soon becomes worse than the natural soil for travel."

"If, on Yonge street, longitudinal pieces of wood were laid as tracks for the wheel, say pieces of wood 20 X 10 in the original form of the English rail road, and the space between macadamized, there is reason to believe that produce could be transported at less than half its present price. At all events, the experiment might be tried with one mile of road, and the results marked."*

In an area where a considerable proportion of the land surface is intersected with gullies and ravines, as is the case in much of the Otter Creek Watershed, the survey lines that determined the road allowances occasionally involved grades that were too steep for safety and convenience, the bridging of streams at awkward angles, and the traversing of swamps that could easily be avoided. At such places, a procedure was provided for making an alteration in the course of the road. A specified number of inhabitants, often given as "twelve or more", submitted a petition to the Court of General Quarter Sessions of the Peace for the District

* Journal of Assembly of Upper Canada, 1831. Appendix, page 207.

concerned; if the Court approved of the application, a surveyor of highways was instructed to make an examination of the proposed alteration and to report on the suitability of the ground for the making of the new road. The Court had further to authorize the acquisition by the Crown of the lands over which the new road must pass, and the disposal of the land, part of the original road allowance, to be abandoned by the alteration. The following is an example of such a petition, asking for a change in the course of the Talbot Road on the east side of its crossing of the East Branch of Otter Creek.

"To their Worships the Justices of the Peace in General Quarter Sessions of the Peace Assembled in and for the District of London to be begun on the Second Tuesday in April and holden at Charlottetown in the said District.

"The Petition of a number of the Inhabitants of the Township of Bayham, in the vicinity of the Otter Creek, on Talbot Road, most Respectfully Sheweth, that the Road, or Highway from Little Otter Creek to the top of Spring Creek Hill East, being attended with several difficult Hills and is irksome and frequently dangerous travelling, may be easily altered and laid through the flats of the said Otter Creek to the Mouth of Spring Creek: thence to the top of the said Spring Creek Hill East, where in a short time it may become an easy and pleasant road, William Hatch, Thomas Neville, and Nathan Caswell being the proprietors of the land, freely and voluntarily give two Rods in width for the use of the Road, provided it is established according to law, who with us have become petitioners, that your Worships may take the case into consideration and proceed agreeable to your judgement and Act of our Legislature in such case made and provided.

"And your Petitioners as in duty bound will ever pray.

"March 22, 1822.

"The prayer of the Petition is granted on condition, that the applicants do furnish a sufficient Bond to convey to His Majesty the land occupied by the Road, as soon as their Deeds have Issued."*

Such roads, constituting a deviation from the lines established by a previous survey, varied in length from

* Survey Records, Department of Lands and Forests, Descriptions, Quarter Sessions Roads, Vol. 5, Elgin and Middlesex Counties, page 33.



1) This road was established in 1822 to give access to the grist mill built by Noah Cook about 1816 on Lot 22, N.T.R. Bayham Township. The line of the road was changed at both ends after 1850; but it continued to cross the East Branch of Otter Creek by a milldam near this bridge and close to the site of Cook's dam.



2) Treffry's Dam at Otterville—a modern spillway on the site of a dam of 1807. The preservation of this early mill site and the old flour mill should be of interest to the Authority. The pond has been used for recreation for about twenty years.

a few yards to several miles. A second example refers to a road some six miles in length, in the Township of Norwich.

"To their Worships the Magistrates of the London District in General Quarter Sessions assembled -

"A request being presented to me by Twelve or more Freeholders for me to explore and take the necessary steps for establishing a road to commence in front of the Third concession of this Township of Norwich between lots number eleven and twelve and to run southerly on side lines of said lots on the Centre of said line to the front of the Eighth concession, and thence as the ground will best admit to the front of the Ninth concession near Norwich Mills [now Otterville], owned by Cromwell and Schooley -

"Having explored the same, I thus notify the same in order for its confirmation at the next Quarter Sessions for the London District -

"Peter Lossing
"Surveyor of Roads

"Norwich, 6th July 1824.

"Confirmed in Open Sessions.
"July 13, 1824.

"G. Ryerson, Chairman."*

In addition to the examples quoted above, the "deviation roads" asked for and authorized between 1821 and 1850 included the following.

- 1821 - a Road commencing on Talbot Street between lots Number Five and Six, leading from thence to the conflux of the Mouth of Big Otter Creek with Lake Erie in the Township of Bayham.
- 1822 - from the Eighth Concession of Bayham to Noah Cook's Mills, thence down the Little Otter Creek Flatts to the Talbot Street in the Township of Bayham.
- 1822 - from Lot No. 23 South Side of Talbot Street, in Middleton Township [at Courtland], to a point in Talbot Street in Lot Number 30 in the same township.
- 1824 - a road from Lot No. 16, in the first concession of the Township of Bayham, to Big Otter Creek.
- 1824 - a Road Two Rods wide, from Number Two in the Fourth Concession of the Township of Bayham, Eastward to intersect the road from Talbot Street to the Mouth of the Big Otter Creek, at Lot No. 5.

* Survey Records, Department of Lands and Forests. Descriptions, Quarter Sessions Roads, Vol. 12, page 73.

- 1824 - a necessary alteration of a piece of Talbot Street, in the Township of Bayham, in Lot No. 112, North Side of Talbot Street.
- 1824 - a Road two Rods wide, from No. 7, Fifth Concession of the Township of Bayham, to Joe Tyrells by the way of Henry Ribble and John Coils and Aaron H. Tyrrells.
- 1825 - a Road, beginning on the Lake Road between Lots Numbers 18 and 19, in the Township of Bayham, running Northwardly till it intersects the Second Concession line.
- 1826 - a road from the line between the Townships of Oxford and Norwich, between lots No. 10 and 11, to proceed to the South along the side line between those lots, until it comes to the bottom lands of the Otter Creek; thence on suitable ground to the house of Joseph Lancaster, and thence south across his fields, to intersect with the line in front of the third concession of the Township of Norwich.
- 1827 - a road from the Scite of the Dereham Forge [later Tillsonburg] to Talbot Street, to intersect the Talbot Road between lots Numbers 15 and 16 (Numbers 123 and 124 on Talbot Road), in the Township of Bayham.
- 1827 - a Road from Talbot Road between the two Otter Creeks to the Eighth Concession of the Township of Bayham, commencing at the Talbot Road, on Josephas Barber's lot, being lot Number 116 North of Talbot Road, thence Northwardly and North Eastwardly until it intersects the Eighth Concession line near the South East Angle of Lot No. Sixteen.
- 1827 - a road in the Township of Bayham, from the Talbot Road near Caleb Cook's, in a direct line as the ground will permit to Jacob Birdsall's Mill, thence in as direct a line as the ground will admit, to Captain Henry Metcalf's Mill and Cloth Factory, and from thence Eastwardly until it intersects the allowance for a road between Lots No. 5 and 6, in the Sixth Concession of the Township of Bayham.
- 1828 - a road commencing at the South East corner of Hugh Webster's lot No. 4 in the fifth concession of the Township of Norwich, thence along the present travelled road to the North West corner of the South half of lot No. 2 in the fifth concession, thence on the division line between James Lake and Benjamin Hilliker, across the lot of George Stover and the Gore of Norwich, to the North West corner of the Township of Windham.
- 1829 - a road from the house of James Ronson, on the Talbot road in the Township of Middleton, Lot No. 23, in a westerly direction, to the commencement of the road leading from the Dereham Iron Works [now Tillsonburg] to Oxford.
- 1829 - a Road commencing near Cromwell's Mills in the Township of Norwich [now Otterville], and

thence to the Talbot Road, near Oliver Edwards, in Windham.

- 1831 - a road to commence at the Talbot Road, being the front of lot Number six, in Bayham, North of the Talbot Road [otherwise No. 114], owned by James Gibbons, Northerly until it intersects the allowance for road between lots No. 5 and 6 a few Rods south of the bank of the Creek near Birdsall's Saw Mill, thence northeastwardly across Otter Creek, above the Mill dam where a bridge is partially raised, thence northwesterly until it intersects the aforesaid allowance again on the Summit of the Hill, on the north side of Otter Creek.
- 1831 - a road to commence at the allowance for road between lots No. 146 and 147 North Side of Talbot Road, opposite Mr. Ervine's, thence westerly to the bottom of Little Otter Creek, so called, near Zebulon Leach's house, thence across said creek, thence northwesterly to the front of the 9th concession of Bayham, to where a Stake is planted at the Northernmost Boundary of Abraham Haven's lot No. 27, 8th Concession of that township.
- 1832 - a road commencing near the Mill of Jeremiah Moore in Bayham, and running across lot Number one hundred and ten North of Talbot Road.
- 1836 - a road from the northwest angle of lot No. 1 in the seventh concession of the Township of Norwich, to the northwest corner of No. 18 in the first concession of Windham.
- 1836 - a road to commence at the Dereham Road in the 2nd concession of Middleton, near the westerly side of lot No. 19 [otherwise No. 160], thence in a westerly direction, crossing the third concession line, to the Townline between Middleton and Bayham, at the distance of 72 chains northerly of the front of the 3rd concession of Middleton. [The Goshen Road]
- 1839 - a road from near the village of Richmond, or Bayham, northwardly to near Andrew Moore's Dwelling House and "the Grist Mill".
- 1844 - a road in the Township of Windham, to commence from the northeast angle of Lot No. 16, in the 3rd concession of Windham, to the dam of Vivian's mill pond [Teeterville], and thence to the side line between lots No. 11 and 12, in the 6th concession of Windham.
- 1845 - a road in the Township of Houghton, from the Town line between Houghton and Bayham, near the north west angle of lot No. 8 in the Range west of the North Road, easterly to the eastern limit of lot No. 9 in the Range East of the North Road, at a point near the north east angle of said lot No. 9.
- 1846 - a road in the Township of Bayham, commencing on the concession line between the 3rd and 4th concessions of Bayham, near the northwest angle

of lot No. 8, in the 3rd concession, to a Stake set in the centre of the Otter Creek road.

- 1846 - a road commencing on the west side of the Township of Houghton, near the southwest angle of lot No. 12 in the Range west of the North Road, to the allowance for road between lots No. 6 and 7, in the 12th concession of the Township of Walsingham.
- 1847 - a road commencing at a point in the line between lots No. 18 and 19 in the 2nd concession of Bayham, thence northerly and easterly, about seven chains, rejoining the same line between the said lots.
- 1847 - a road in the Township of Bayham, commencing at the front of the fifth concession on the limit between lots No. 24 and 25, thence north and easterly "descend the ravine to the Saw Mill", "to the side of the Mill Pond", "crossing the Mill dam", "crossing the Travelled Road at the East side of the Mill, at Five chains West of the side Road between lots twenty five and twenty six in the said concession".
- 1849 - a road in the Township of Bayham, commencing on the east side of the road allowance between lots No. 25 and 26, in the 8th concession, thence northerly and easterly "to a public High Way, and very near to the South Easterly Corner of an old log building".

In 1851, the plank and gravel road was completed from Port Burwell to Ingersoll. This thoroughfare greatly facilitated the movement of timber and produce to the lake, being a main trunk line from north to south. The old village of Sandytown was in existence before this time on the lot taken up by C. Hunsberger (Christian Hunsbury, on Lot No. 123, South side of Talbot Road), about half a mile west of the present village of Straffordville. This latter village, and the village of Eden, five miles farther north, both came into being as a result of the construction of the plank road.*

Writing of the old days in Tillsonburg, a contributor to the Tillsonburg Liberal, December 9, 1886, says of the plank road:

"The plank road between Ingersoll and Port Burwell proved a great boon to the lumbering interests, and the long line of lumber teams was a familiar sight in those days. Large quantities of lumber were teamed to Ingersoll, where it was shipped by rail."

* This paragraph is adapted from the Historical Atlas of Elgin County, 1877.

The plank road was operated as a profit-making business, by the Ingersoll and Port Burwell Road Company, whose revenue was derived from tolls charged at eight toll-gates, distributed at intervals of about four miles along the thirty miles of the road's length. In the Sixteenth Annual Report of the Directors of the company, submitted December 11, 1865, the collections for two successive years are shown:

"Collected at the gates since last report;
likewise the amount shown as collected in 1864:

	<u>1864</u>	<u>1865</u>
"From Gate No. 1	\$1405.00	\$1327.00
No. 2	1437.25	1363.00
No. 3	977.25	829.75
No. 4	1138.50	1047.25
No. 5	757.75	946.00
No. 6	834.50	1168.25
No. 7	2560.50	2976.25
No. 8	451.25	507.75
	<hr/>	<hr/>
	\$9562.00	\$10165.25 "

When the plank road was newly laid, and in good condition, travel on it was pleasant and smooth; but there is evidence to show that, after the lapse of a few years, it was difficult to maintain the smoothness and the safety of travel once the planks were warped and worn, and dislodged from their proper alignment. Their condition within the limits of the village of Tillsonburg may be judged by the comments of a letter published in the Tillsonburg Observer, October 25, 1866:

"To the Editor of the Observer: -

"Sir, - Can you inform the public whether it is the intention of the Plank Road Company to leave the portion of their road passing through your village in its present disgraceful state during the Winter? If so, they may safely calculate upon having a few actions for damages to defend as soon as the inequalities are covered with snow.

"A LOVER OF GOOD ROADS

"Dereham, Oct. 23, 1866."

By 1877, the writer of the Historical Atlas of Elgin County spoke for much more than the townships of his own county when he said:

"The days of corduroy and stick-in-the-mud are past, and few townships can now boast of better roads; many have been well graded and gravelled by township grants and statute labor."

2. Railways

The early schemes for the incorporation of railway companies in Upper Canada included a few that contemplated railway lines running parallel to the shores of the two lower Great Lakes, Lakes Ontario and Erie: such were the Great Western Railway, the Erie and Niagara Extension Railway, and the Canada Air Line Railway. But the great majority of the railway companies incorporated between 1834 and 1872 were designed to serve as local feeders, to transport goods and passengers to and from the lake ports that provided channels of access to points either east or west, or across the lakes to the ports of the United States. A conspicuous example of the emphasis on north-south lines is provided by the array of Acts of the Ontario Legislature to which the Royal Assent was given on March 2, 1872; on that day no less than twenty-one Acts were assented to that either incorporated railway companies or that amended existing legislation by which railway companies were already incorporated, and of these twenty-one railways, seventeen were north-south, three were east-west, and one - the Toronto, Grey and Bruce Railway - possesses the characteristics of both categories.

(a) Woodstock and Lake Erie Railway

On April 15, 1848, the Royal Assent was given to "An Act to incorporate the Woodstock and Lake Erie Rail-way and Harbour Company", which provided that the Company should have full power

"to lay out, construct, make and finish a double or single iron or wooden Rail-road or Way . . . between the Town of Woodstock and the harbours of Port Dover and Port Burwell inclusive, on Lake Erie."

For about five years the company remained dormant; but in 1852, "efforts began to be made by the then Directors

professedly to give effect to the provisions of the said Act, to obtain further time for the commencement of the works, and to enable the said Company to continue their road from Simcoe and Port Dover, in the County of Norfolk, to Dunnville, in the County of Haldimand".* The prolonged period of inactivity had caused many people to doubt the bona-fides of the Directors. The display of activity in 1852 and 1853 tended to allay the doubts, and the company was able to obtain from the Townships of Norwich, Windham, and Woodhouse, and from the Town of Simcoe, loans in aid of the enterprise, amounting in all to £145,000. The agents who visited the municipalities and negotiated these loans later testified that "the representations made by them to the municipalities on the faith of assurances made, and in pursuance of instructions from members of the Board of Directors in nearly every instance and on every essential particular, subsequently proved to be false".* Throughout the term of its existence as a company, the moneys thus obtained by fraud from the four municipalities involved constituted almost the only funds the company possessed. The Report of the Select Committee continues:

"Being thus successful in the accomplishment of their designs, the further proceedings of certain of the Directors and their accomplices in guilt, are marked by a degree of recklessness and violation of faith and honorable dealing, which Your Committee find it difficult to select words to characterise as they deserve."

Among the "proceedings" of the sort thus referred to, the Select Committee found evidence of the following.

- (1) Ejecting one Director from his seat on the grounds that he had not paid up his calls on the stock subscribed by him: "a most extraordinary ground of objection for a body to take who had themselves paid but a nominal sum on their own stock, and when . . . no calls were ever officially made on the Stockholders".

* Report of the Select Committee appointed to investigate the affairs of the Woodstock and Lake Erie Railway and Harbour Company, May 20, 1857. Journal of Legislative Assembly, Province of Canada, 1857: Appendix No. 6.

- (2) Overcoming the "scruples" of a township Reeve by a bribe, the original amount of which was \$1,000, but which was quietly reduced to \$900 by the middleman: "one hundred of which he deducted for his own services in negotiating the transaction, and the balance he handed to the Reeve as payment in full for the removal of his scruples".
- (3) Payment of a bribe of \$50,000 to one of the Directors for his services in obtaining the construction contract for the firm of Zimmerman and Company, a company in which the Director concerned had an interest to the extent of one-fifth of the profits.
- (4) Payment by an agent of the Great Western Railway of "a direct bribe of \$100,000 to obtain the removal of three of the Directors, and the substitution in their stead of three of his own nominees, he having previously succeeded in securing without purchase the remaining four to accede to and aid him in carrying out his plans for the transference of the charter to a rival company".

To the mass of evidence which the Select Committee accumulated and attached to its Report, the unhappy Committee directed the attention of "Your Honorable House" in the following words.

"Throughout it exhibits unmistakeable evidence of bad faith, deceit, reckless extravagance, and mal-appropriation of the moneys entrusted to the Company by the municipalities."

One further blow was yet to fall on the prospects of this ill-starred company. Mr. Samuel Zimmerman, of the firm of Zimmerman and Company, who had entered into contract for the actual construction of the proposed railway, and who has been described as its "chief promoter", was killed on March 12, 1857, when a train of the Toronto and Hamilton Railway plunged through a high-level bridge over the Desjardin Canal, near Hamilton, and fell forty feet into the water below, with the loss of about eighty lives.* No further serious effort was ever made to complete the construction of the Woodstock and Lake Erie Railway.

* Toronto Globe, March 13, 1857.

(b) Port Dover and Lake Huron Railway

Fifteen years after the death of Mr. Zimmerman, and the consequent cessation of efforts to promote the Woodstock and Lake Erie Railway, a new company was incorporated; and by 1876 was in operation, to a large extent following the line that had been projected for the former road.

An Act to incorporate the Port Dover and Lake Huron Railway Company was passed in 1872, and received Royal Assent on March 2nd of that year. The Act provided for the laying out and construction of a line of railway,

"from any point on the shore of Lake Erie between Port Dover and Port Rowan, or at or near the Town of Port Dover, to the Town of Woodstock, with power to extend the same to the Town of Stratford; and it shall be lawful for the said company to acquire for the purposes of their undertaking the lands and road-bed of the Woodstock and Lake Erie Railway and Harbour Company in the same manner, and on like terms, and with like powers as far as applicable, as the company may acquire the lands of individuals".

The line of this railway is shown in the Historical Atlas of Oxford County, 1876, and the similar Atlas of Norfolk County, 1877, passing from Port Dover, through the Town of Simcoe, across the Townships of Windham and Norwich, to Woodstock.

(c) Erie and Niagara Extension Railway
(Canada Southern Railway)

The Act for the incorporation of the Erie and Niagara Extension Railway Company was passed in 1868, and provided for the construction of a line of railway,

"from a point in the Township of Bertie, at or near the Village of Fort Erie, passing through the Town of Saint Thomas, to some point in the County of Essex".

On December 24, 1869, the Act was amended, and the name of the company was changed to "the Canada Southern Railway Company". Among other things, the amending Act provided (Section 5) that:

"it shall be lawful for the corporation of any municipality or municipalities through any part of which, or near which, the railway or works of the said company shall pass, or be situated,

or which may be benefited thereby, to aid or assist the said company by loaning, or guaranteeing, or giving money by way of bonus, or other means, to the company, and by purchasing and granting to the said company the land for the right of way, station grounds, gravel pits and workshops, and otherwise, in such manner and to such extent as such municipal corporation or corporations, or any of them, may think expedient."

One of the townships that aided the construction of the Canada Southern Railway was South Norwich, the by-law for that purpose being passed on October 9, 1870. The line of the Canada Southern crossed the township from east to west entirely within the limits of the eleventh concession, and later became the line of the Michigan Central Railroad.

(d) Canada Air Line Railway*

This was another east-west railway, one of the few that were designed to operate along a line roughly parallel to the shores of Lake Erie. Royal Assent was given on December 24, 1869, to "An Act to incorporate The Canada Air Line Railway Company", which was empowered to construct

"a railway from such point on the line of the Great Western Railway, as may be found most eligible, at Glencoe, passing on such route as may be selected, through the town of St. Thomas, and thence passing through or near Simcoe, then through Cayuga, connecting with the Buffalo and Lake Huron Railway near Canfield or Dunnville, and thence extending to some point on the Niagara river, near Fort Erie, and no part of the line east of St. Thomas shall be open for traffic until the line between Glencoe and St. Thomas shall be completely finished".

According to the Bayham Township Centennial Souvenir Book, 1850-1950, by 1871, this line of railway had been completed from St. Thomas to Tillsonburg, passing through the village of Corinth. In the Atlas of Norfolk County, 1877, The Canada Air Line Railway is shown as passing through Courtland and Delhi, in the Township of Middleton. The line subsequently became part of the Canadian National Railways.

* "Air Line": the equivalent of "bee-line", or "as the crow flies".

(e) Port Burwell and Ingersoll Railway

This was one of the numerous railways incorporated by statute assented to March 2nd, 1872. The Act was entitled "An Act to incorporate the Port Burwell and Ingersoll Railway Company". The line of its construction was indicated in the following section of the Act.

"The company shall have full power under this Act to construct a railway from any point in or near the Village of Port Burwell running north to a point in or near the Village of Tilsonburg, and thence to the Town of Ingersoll, with power to extend the same to the Town of St. Marys."

It is not clear to what extent this railway was in whole or in part identical with the Tilsonburg, Lake Erie and Pacific Railway, discussed below. The line in later years became a part of the Canadian Pacific Railway.

(f) The Norfolk Railway (Brantford, Norfolk and Port Burwell Railway)

"An Act to Incorporate the Norfolk Railway Company" received the Royal Assent on January 23, 1869, and, in its original form, the line of this road did not pass over any part of the Otter Creek Watershed. But the original Act was amended, March 24, 1874, the corporate name was changed to the Brantford, Norfolk and Port Burwell Railway Company, and the line of its proposed construction was extended to include a route through the Townships of Burford, North Norwich, Dereham, Middleton and Bayham, and to pass from Brantford, through Tillsonburg and Vienna, to Port Burwell.

The Act of Amendment recited the names of the several municipalities that had granted sums "in aid of the construction of the said railway situate between the town of Brantford and Port Burwell the same are hereby confirmed".

The grants-in-aid that were thus confirmed were the following:

The Town of Brantford	\$ 70,000
The Town of Tillsonburg	8,000
The Village of Vienna	4,000
The Township of Bayham	30,000
The Township of Burford	30,000
The Township of North Norwich	30,000
The Township of Houghton	10,000

Total \$182,000

In 1879, the Acts relating to the Brantford, Norfolk and Port Burwell Railway Company were further amended, the company having petitioned for an extension of time in which to complete "its railway and branches". The preamble to the new Act of amendment states that the company

"has completed thirty-five miles of its railway, from the City of Brantford to a point in the Township of Middleton, and that by-laws for the granting of bonuses to aid the company in the further construction of its railway to or near to Port Burwell have been passed by municipalities through and adjacent to which the said line of railway to, or near to, Port Burwell would run".

Nevertheless, the section of this railway that was to have connected Port Burwell with Tillsonburg was never completed. The free excursion that, in 1875, celebrated the completion of the road from Brantford to Tillsonburg marked, for all practical purposes, the end of construction of the Brantford, Norfolk and Port Burwell Railway.

(g) Tilsonburg, Lake Erie and Pacific Railway

The Port Burwell Centennial Souvenir Book, 1930, gives a brief history of the "T., L.E. & P."

"In 1875 a strong agitation was going on in favor of the proposed Brantford and Port Burwell Railway, which was in operation as far as Tillsonburg.

"The agitation for the extension of the railway to the Port continued until in 1895 the work of constructing a line from Tillsonburg to the Port, to be known as the T., L.E. and P., or Tilsonburg, Lake Erie and Pacific Railway, over a line some seventeen miles distant from the Port, was undertaken and completed the same year. The charter for the new railway had been secured several years previous to its final completion. The board of managers and directors for the new road were:

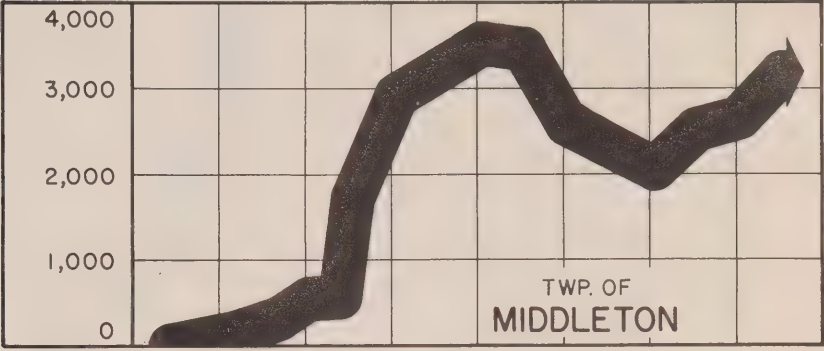
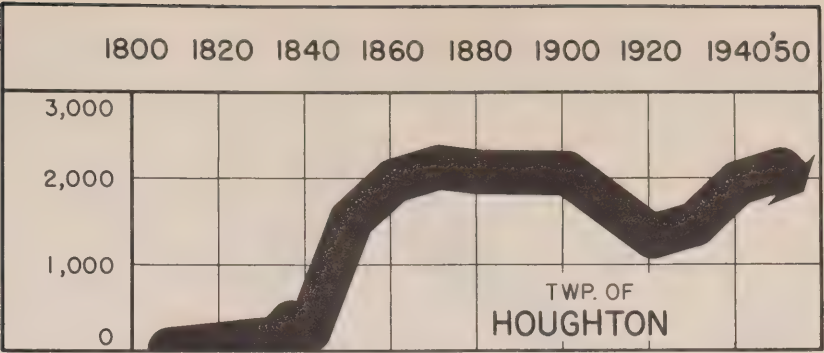
"Mr. John H. Teall, general manager.
"S.S. Clutton, president.
"B. Jackson, treasurer and director.
"W.S. Law, clerk and director.
"Thomas Jenkins, and
"W. Backhouse, directors.

"The contractors who had charge of the work were McDaniel and Company, and the first train which passed over the line when completed arrived in the Port, December 31st, 1895. J.H. Teall was the conductor, F.H. Williams, brakeman, and Graham Simington the engineer. Squire William Backhouse was the first local station agent, which office he held until the railway was taken over by the C.P.R. five years later.

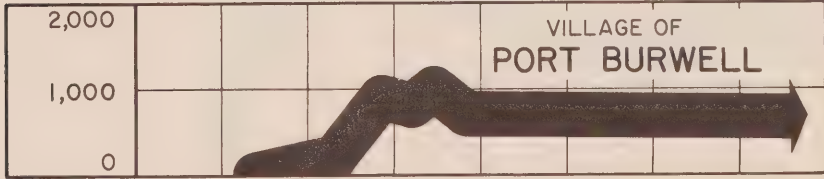
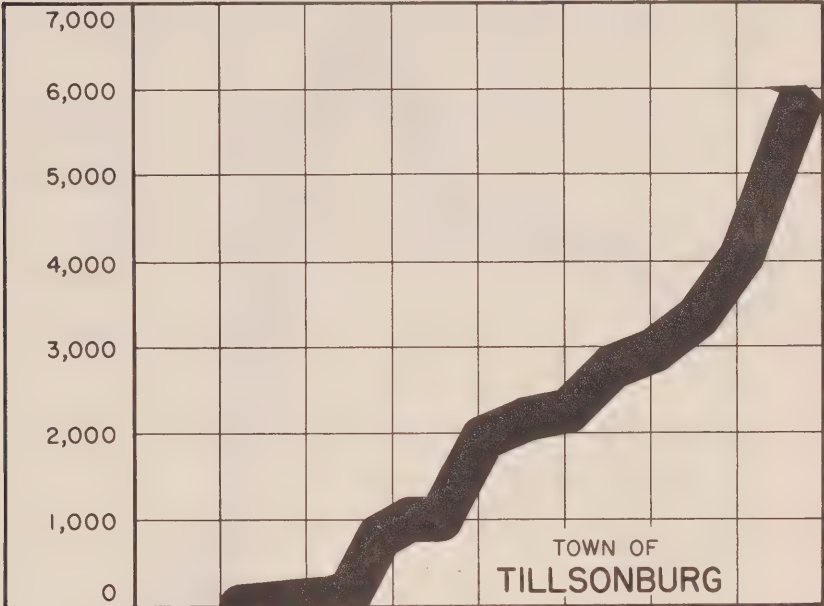
"The new railway received municipal bonuses besides considerable of the right of way gratis, the grants being:- Vienna, \$3,000; Bayham Township, \$35,000; Houghton West, \$3,000; Malahide Southeast, \$3,000; and Tillsonburg, \$8,000. Subsidies granted by the Federal Government, \$2,500 per mile; and the Ontario Government, \$15,000."

In addition to the forms of assistance mentioned in the passage quoted above, the Township of Bayham had, on March 6, 1893, passed a by-law to authorize the transfer of the Port Burwell harbour to the railway company. The time allowed for the completion of the line, set originally for December 31, 1892, was extended "until the thirty-first day of December, A.D. 1895", the date when, according to the Souvenir Book, "the first train arrived in the Port".

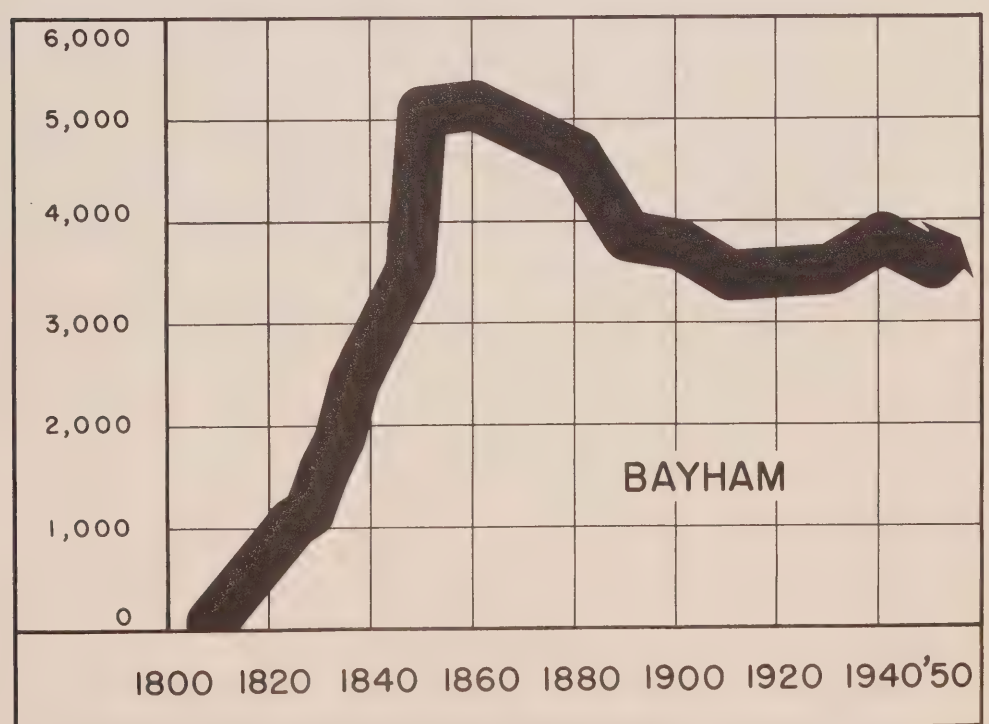
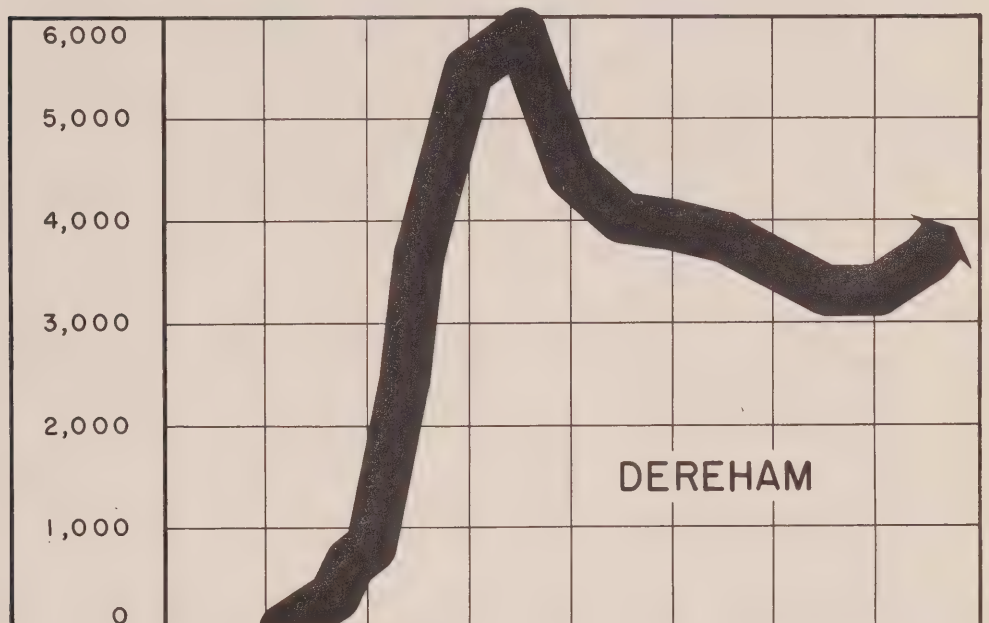
Of the seven railway companies whose lines have served the watershed with which this report is concerned, not one has retained its individual incorporation, direction, and management. All have become part of one or another of the two great Canadian railway systems and the one non-Canadian line which, in 1957, continue to serve the communities in the Otter Creek Watershed.



HOUGHTON AND MIDDLETON TOWNSHIPS WERE UNITED UNTIL 1834. THE TOTAL FIGURES GIVEN BEFORE 1824-34 HAVE BEEN DIVIDED IN THE PROPORTION SHOWN IN THE NEXT FIVE YEARS.



POPULATION



TOWNSHIP POPULATION

LAND

GEOGRAPHIC ASPECTS OF THE OTTER CREEK WATERSHED

1. Introduction

The Otter Creek valley extends north from Port Burwell a distance of 29 miles and comprises an area of approximately 316 square miles, or 202,200 acres. The valley is drained by the Otter Creek which debouches into Lake Erie at Port Burwell. Its chief tributary is the Little Otter Creek which enters the main stream about 6 miles north from the lake. Another stream, also known as Little Otter Creek, is included within the watershed but it drains independently into the lake on the eastern outskirts of Port Burwell.

From the northern boundary, in the moraine north and west of Norwich, the land drops from an elevation of about 1,050 feet a.s.l.* to about 575 feet a.s.l. at the lake. At the lake there are steep bluffs up to 100 feet high. The regional slope of the sand plain south from Otterville and Tillsonburg to the top of the lake bluff is quite low; in many places the landscape appears almost level.

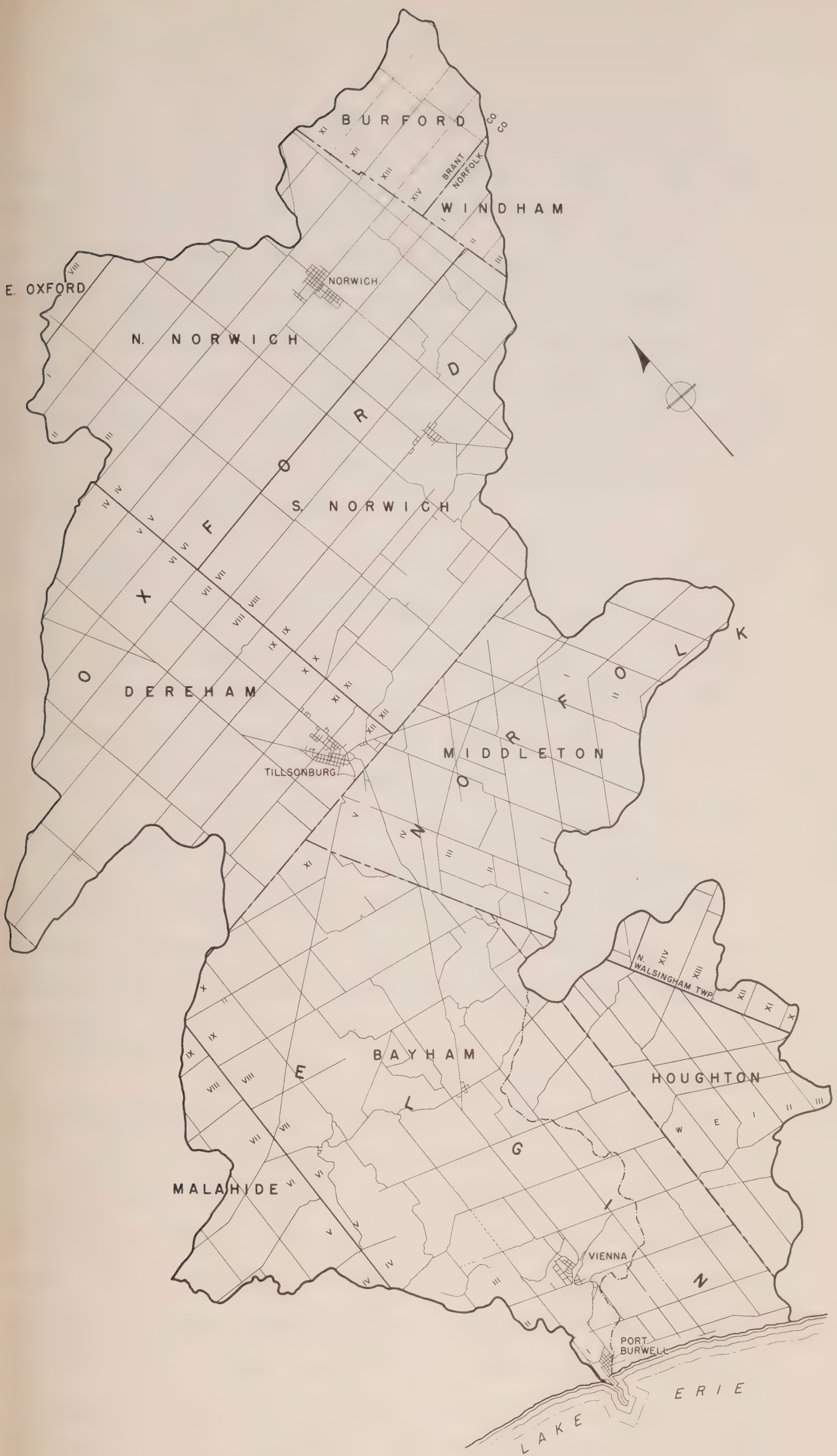
The watershed includes a number of municipalities - parts of the Counties of Norfolk, Oxford, Brant, Elgin and Middlesex and portions of twelve townships. The chief towns and villages are those of Tillsonburg (6,016), Norwich (1,547), Port Burwell (688), and Vienna (335)†. In addition there are a number of police villages and hamlets such as Otterville and Bayham.

2. Bedrock Geology

Throughout the watershed the bedrocks are covered by thick deposits of unconsolidated materials - the older tills, Wisconsin drift, stratified sands and gravels, and lacustrine clays and silts. These deposits may be up to 100 feet or more deep in the north and up to 250 or more

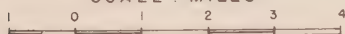
* above sea level.

† Population figures from 1956 Municipal Directory, Department of Municipal Affairs.



MUNICIPALITIES

SCALE : MILES



feet thick in the vicinity of Port Burwell. At no point is the bedrock exposed.

The limestones underlying the region belong to the Delaware and Detroit River - Onondaga Oriskany formations. Because of their great depth below the surface these rocks are of little importance except in one respect; some of the artesian waters are sulphurous, especially those coming from the Delaware rocks, and may be unfit for human consumption although quite suitable for stockwatering, certain industrial purposes and even irrigation. The water supply in the top few feet of the rock may be potable but polluted by mineral materials at greater depth.

3. Climate

The climate of this part of Ontario may be described fairly well from the weather records of the several recording stations in the locality. A better understanding of the regional climate may be had, however, only after recourse to the statistics covering a much wider area.

Most of the Otter Creek Watershed lies within a climatic region called by Putnam and Chapman the "Lake Erie Counties".* Nearly all of the sand plain and the southern portions of some of the moraines lie within this region. The northern section of higher elevation belongs to the region described as the "South Slopes".

The Lake Erie Counties climatic region varies in width and extends from Toronto on the east to Lake Huron on the west. Its northern boundary extends south-westwards from Toronto through Dundas to near Tillsonburg and thence north-westwards to reach Lake Huron south of the Huron-Lambton county line. The region occupies all of the land south of this line with the exception of that belonging to the Niagara Fruit Belt and the area west of Ridgetown-Sarnia. The South

* Putnam, D. F. and Chapman, L.J. The Climate of Southern Ontario. Scientific Agriculture 18:8, April, 1938.

Slopes region extends from western Middlesex to Frontenac County.

Putnam and Chapman have described these two regions as follows:

(a) Lake Erie Counties

"This region, bounded by Lake Erie on the south, Lake Ontario to the east and Lake Huron to the west, has a climate modified by the influence of these lakes as shown by the mean daily range of temperature, frost dates and length of growing season. Although having a warm, early season it is not quite so well favored as the three regions previously outlined. It is an area of gentle relief, varying in elevation from about 600' to slightly over 800', the most prominent features being the crests of some of the glacial moraines.

"Except in the Niagara Peninsula, the northern boundary is formed by the annual isotherm of 45°. Winter temperature ranges from 23° to 24°. Spring temperatures are about 43°, with 42° along the northern border and also along the shore of Lake Erie. Summer temperatures average about 67° with 66° along Lake Erie. Fall temperatures vary from 48° to 50°, being warmer along the lake shores. The extreme low temperatures range from -21° to -35° and the highest temperature ever recorded is 106. The frost-free period varies from 160 to 135 days, depending on the distance from the lakes. On the other hand the growing season has a fairly uniform length of about 200 days from the middle of April to the first week in November.

"The average precipitation is 33.8 inches, but is heavier in Norfolk, Elgin and Middlesex and lighter both to the east and west. The normal snowfall varies from 40 to 90 inches in the same manner. The growing season receives slightly over half the precipitation. The P-E index for the three summer months ranges from 10.5 to 13.5. The drought frequency is about 20, strangely enough, being higher in the areas receiving greater precipitation. The greater rainfall in the central part of the region is not apparent because of the sandy soils."

(b) The South Slopes

"To the north of the Lake Erie region and the Lake Ontario shore there is a belt of country with a southern exposure, in which the climate is somewhat milder than that of the regions to the north, but which does not enjoy the modification of the lake influence to the extent of the first-mentioned areas. In altitude, most of the area ranges from 500 to 1,000 feet above sea level.

"The mean annual temperature ranges from 43° to 45°. The winter isotherms of 18° and 19° approximate the northern boundary and in some parts 23° is reached. The spring mean ranges from 41° to 42° at most stations and is similar to that of the Lake Ontario shore; the summer mean of 66° is also similar. The fall temperature mean of 47° is intermediate between that of the lake regions and that of the Western uplands. The temperature extremes at the various stations are: low, -27° to -39°; high, 101° to 105°; the greatest range at any one station

being 143°. The mean daily range of 19° is wider than that of the shore regions but similar to much of the territory to the north. The average length of the frost-free period ranges from 133 to 147 days, from May 11 to 20 until September 28 or in some places October 3. This is from one to two weeks longer than the central part of the uplands and certain parts of Simcoe county. The growing season of 192 to 200 days is similar to that of the Lake Erie and Lake Ontario regions but definitely longer than that of the regions to the north.

"Annual precipitation varies from 32 to 38 inches, with a little less than half falling between April 1 and September 30, and from 7.0 to 9.6 inches in June, July and August. Snowfall varies from 50 to 90 inches."

There is some correspondence between the northern boundary of the Lake Erie Counties region and that of Halliday's Deciduous Forest Region*. The latter notes that this region, because of favourable climatic and soil conditions, allows "for the sole distribution in Canada of many Deciduous Forest species". He also observes that "a large number of these species find their northern limit here".

There is perhaps no particular climatic control governing the growth of agricultural crops from one region to the other but there is no doubt that for some crops at least some varieties will fare better in one zone than in another. Length of time to maturity, length of frost-free season and length of growing season are important factors respecting variety suitability. Crop varieties should be selected with reference to climatic conditions in order to obtain the best yields. At least one crop, peaches, is restricted to the lakefront, chiefly because of the more equable climate found there.







4. Physiography

During the past million years Southern Ontario has been covered at least three times by major continental glaciers. The last of the ice, that of the Wisconsin glaciation, vanished from the Otter Creek area perhaps 15,000


* Halliday, W.E.D. A Forest Classification for Canada. Department of Resources and Development, Forest Research Division, Ottawa. Bul. 89, 1937.

PHYSIOGRAPHY

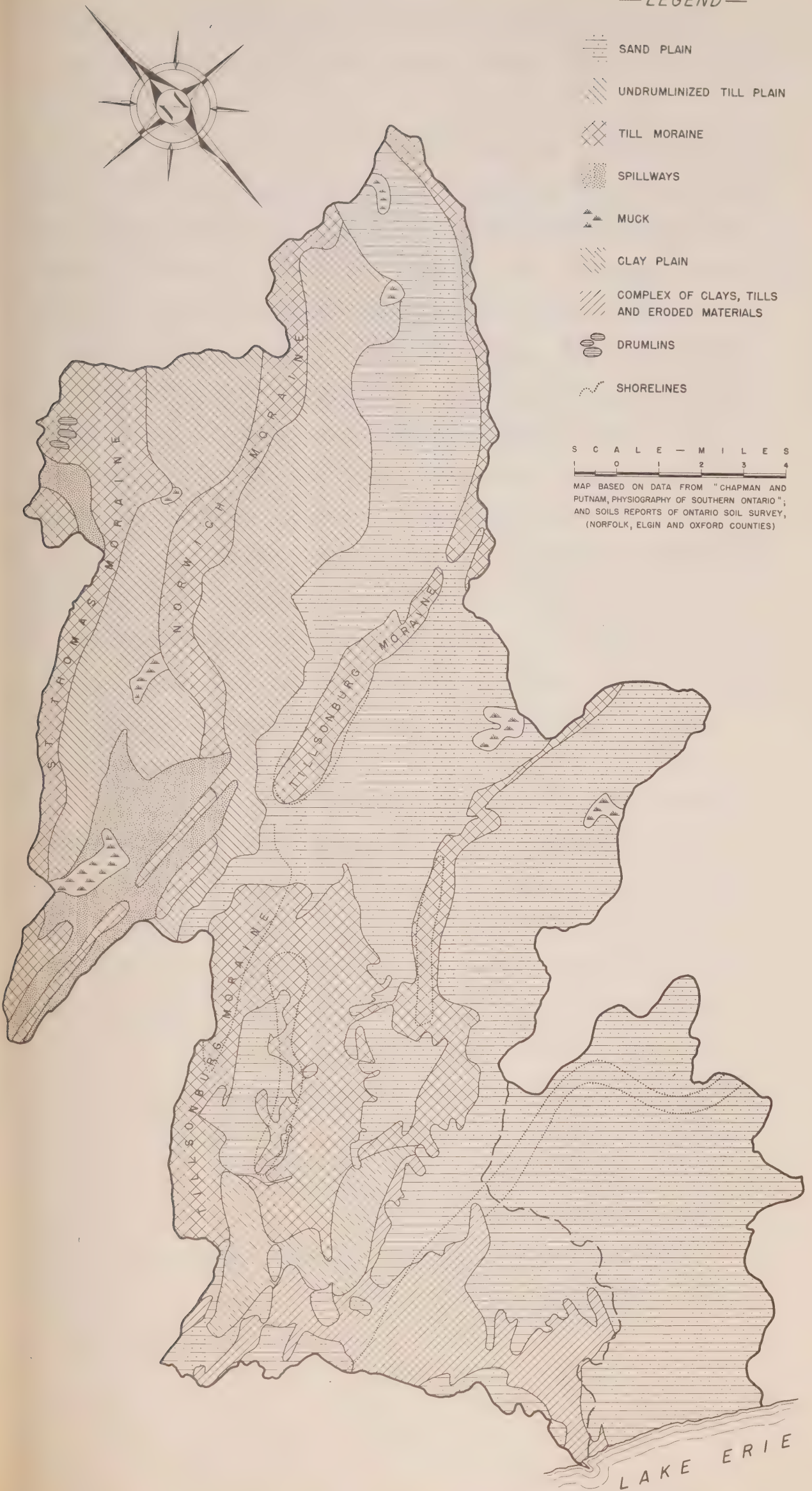
— LEGEND —

-  SAND PLAIN
-  UNDRUMLINIZED TILL PLAIN
-  TILL MORaine
-  SPILLWAYS
-  MUCK
-  CLAY PLAIN
-  COMPLEX OF CLAYS, TILLS AND ERODED MATERIALS
-  DRUMLINS
-  SHORELINES

S C A L E — M I L E S



MAP BASED ON DATA FROM "CHAPMAN AND PUTNAM, PHYSIOGRAPHY OF SOUTHERN ONTARIO"; AND SOILS REPORTS OF ONTARIO SOIL SURVEY, (NORFOLK, ELGIN AND OXFORD COUNTIES)



years ago. Each of these three major ice advances and recessions was marked by many minor, often local, fluctuations in the ice front.

Nearly all of the present-day topography is the direct result of the activity of the Wisconsin ice sheet, and particularly of the fluctuations affecting it before it finally withdrew. Coincident with the ice recession, resulting from a general climatic warming, there came vast outpourings of meltwaters. These were dammed up, partly by the as yet unmelted ice and partly by new lines of hills created by the ice, to form extensive glacial lakes. These lakes were important in the creation of extensive level plains of sand, clay and silt which are common over much of Ontario.

So far as present-day topography is concerned the glaciations of pre-Wisconsin Age have little importance in the Otter Creek area, although there is evidence that some of the present moraines are remodelled pre-Wisconsin deposits. Also, some of the heavier tills are undoubtedly reworked lacustrine clays and silts.

These early till sheets are important with reference to the water supplies of south-western Ontario. Most of the drinking water comes from the beds of stratified sands and gravels which lie between the layers of till. Good sections of these old till sheets and their stratified interbeds may be seen in the lower valley of the Otter Creek.

In the Otter Creek region several types of glacial landforms may be recognized: till plain, till moraine, spillways and drumlins. There are also landforms resulting from the glacial lakes: sand plains, clay plains, sand dunes and shorelines. Finally there are the post-glacial developments - the present drainage pattern, the peat and muck deposits, the steep receding bluffs cut by Lake Erie, and the present variety of soils.

During the general retreat of the ice sheet the Erie lobe (occupying and spreading out from the Lake Erie Basin) was probably of most importance in building much of the scenery of the watershed. Over a period of time it advanced and receded several times, from and to the general area of present Lake Erie, and in the course of these advances or retreats constructed several moraines. These moraines are long, knobby ridges built up of till, an unconsolidated, unstratified mixture of clay, sand and irregularly shaped stones and boulders. The till of a moraine may range from coarse and bouldery to heavy and largely stonefree. The morainic deposits within the watershed are chiefly of the latter type. The irregularly-shaped depressions between the knobs are frequently poorly drained and may contain peat or muck deposits.

There are three moraines within the watershed: the St. Thomas (Mt. Elgin Ridges), the Norwich, and the Tillsonburg. Associated with the first two is an extensive network of spillways, the drainage channels formed by the vast amounts of water pouring off the melting ice. These valleys may be quite wide, are often poorly drained, have sandy and gravelly soils and are often best used as forest land. They may or may not contain small streams at the present day.

The soils of these moraines have been mapped by the Ontario Soil Survey as belonging to the Guelph and Huron catenas and these are discussed in the section of this report relating to soils. The former is considered to be a medium-textured till and is somewhat stonier than the Huron, a soil developed in heavy-textured till. The well drained members of both catenas are fairly fertile but subject to erosion. They are unsuitable for flue-cured tobacco but good for dairy and beef farming and some cash crops. In many places there is an abrupt change in the cultural landscape as one passes from the sand plain into the moraine or till plain.

The till plain is confined to the north-west section of the watershed and the general aspect is similar in many ways to that of the moraines. The topography is more subdued, however, and the slopes are longer and not as steep. Drainage imperfections are often widespread. A till sheet is formed under a moving mass of ice, rather than along the perimeter of a lobe as is the case with a moraine. In this area the land uses are much like those of the moraines, but there is, perhaps, more emphasis on cash crops, and also some orchard development. Perhaps the chief conservation problem of the till plain is that of drainage improvement.

Drumlins are oval hills formed out of till under a moving ice mass. Locally they may be called whale-back hills or hogsbacks. In Ontario they are found in great fields and are common to the till plains where loamy soil materials predominate. The heavy till plain of the watershed is undrumlinized but several drumlins are found in the extreme north-west corner of the watershed. These are peripheral to the Woodstock drumlin field.

The soils of a drumlin are usually quite fertile but may be stony. The moderately to steeply sloping land is subject to severe erosion unless well managed. Where drumlins are numerous the land between them is often wet and suitable only for forest or pasture.

With the creation of the large glacial lakes a good deal of the present Otter Creek Watershed was under water. Two of these lakes, Whittlesey and Warren, are of particular significance with respect to this area. At the time of Lake Whittlesey the present Lake Ontario basin, the Niagara peninsula, and the eastern portion of the present Lake Erie basin were ice covered. The Huron lobe overlapped the boundaries of the present Huron basin, and the central portion of Western Ontario was dry land. As the ice melted vast amounts of water poured south down the spillways through the

Guelph and Brantford areas. The waters carried immense amounts of sand which were deposited in the lake as a delta to form, subsequently, the Norfolk sand plain. A large volume of sand was also deposited in Lake Warren. Portions of some of the moraines were wholly or partially buried by the sands.

These sands are not rated highly for dairying or general farming because their inherent fertility is low, they are inclined to be droughty after the end of spring, and because of the low organic content and the rapidity with which nutrients are leached out. When regularly cultivated and not protected they become subject to wind erosion. Their failure to return an adequate income for the labour and money expended, and the considerable wind erosion in some areas, led to an extensive program of reforestation after 1908.* Thousands of acres were thus treated over the years and include provincial and county forests and many small private plantings. The Otter Creek Conservation Authority should continue this program.

Although the soils of the sand plain proved unsatisfactory for productive dairying or general farming those which were well drained proved eminently suitable for the production of bright leaf tobacco. These soils were so suitable, in fact, that this crop in 1954 ranked second in gross value in Ontario after hay and clover, and used 120,804 acres of land.† Because of drought, disease and frost the 1955 crop was smaller. Not all of the crop is produced on the sands in the Norfolk area, of course, but by far the largest amount is grown there.

The sands have also proved suitable for the production of peaches, particularly along the lakefront where extensive orchards are situated. Local climatic amelioration,

* E. J. Zavitz. Report on the Reforestation of Waste Land in Southern Ontario. Ontario Department of Agriculture, 1908.

† The gross farm value for tobacco in 1954 was \$74,174,000, and for hay and clover \$87,646,000.

induced by the lake, is undoubtedly a factor in this development.

The open nature of the sand leads to a rapid infiltration of precipitation and also of good movement of the groundwaters. The underlying clays and tills (the sands may be a few inches to 60 or 70 feet deep) provide an impermeable layer and produce a fairly high watertable. As a result of this good water in fairly plentiful supply is easily obtained.

Although the sand is coarse textured not all of it is by any means well drained. Many thousands of acres are imperfectly or poorly drained and the land is generally not suitable for the production of tobacco or orchard crops. A large portion of this land is covered by unimproved forest and poor scrub and, where cleared, is often left idle. Some of the land is used to pasture the horses necessary in tobacco harvesting.

So long as tobacco continues to be the major agricultural occupation of the people on the sand plain, so too will this pattern persist. Under the circumstances it would be well if the present forest cover on these lands was managed, and the poor scrub and idle lands reforested. The Otter Authority can play a major role in the improvement and rehabilitation of these lands.

The glacial lakes persisted for some time and as a result there developed wave-cut bluffs, beaches and off-shore bars. These features are like those found on the shore of present Lake Erie but are not usually as well developed. A beach and bluff may be found around part of the moraine immediately north of Tillsonburg and others may be seen south and west of the town, again in the moraine. Another set crosses the watershed in an east-west direction just south of Straffordville. Deposits of gravel and of larger stones are often found with the beachlines, particularly where the waves cut into the tills on the moraines. The lack of substantial deposits reflects, however, the stonefree nature of the heavy

tills. These sites are at times useful for the commercial extraction of gravel, as are the spillways.

There are also many dunes through the area. The more extensive, belt-like developments relate to the glacial lakes in all probability but it is certain many of the smaller ones have developed since, particularly after settlement and land clearing when the light, unprotected soils were allowed to blow. Most of the dunes are unsuitable for cultivation and are best covered by trees and permanent grass. Many have been reforested.

In addition to the till plain and clay moraines there are two other areas of heavier soil on the watershed. One of these is the clay plain in the vicinity of Bayham. The other is contiguous to this plain and extends from it along both sides of the river to the mouth. It is highly likely the latter is, to a considerable extent, the result of erosion stripping off the former sand cover and laying bare the heavier subsoils. Many tributaries enter the stream along this part of its course and severely eroded slopes are common. The steeper of these should be reforested, either privately or with Authority support. It should be recognized, however, that the nature of the soil material and the steepness of the slopes might combine to make successful planting difficult.

A spectacular feature of the watershed is the river valley itself. In its upper reaches it is little different from any other but the lower portion is deeply incised in the near-level plain. The deep valley of this and adjacent streams has had considerable influence on the road system. Bridging these cuts would be difficult and the expense of so doing prohibitive. Where roads have been continued through the valleys they are often tortuous and steep.

There is a significant relationship between the river and the soil materials through which it and its tributaries flow. Examination of the map relating to stream flow

which is found elsewhere in this report, reveals the fact that most of the permanent flow originates in the sand lands. The tributaries drying up completely in summer, or to standing pools, are those whose watersheds are mainly or wholly in the areas of heavier soils. Most of the streams in the north-west portion of the watershed are dry through part of the summer. The same is true of the streams entering that portion of the river flowing through the moraine south of Tillsonburg. The clay lands upstream from Vienna show a similar development.

The physiographic feature which may be considered finally is that of the present lakeshore. The bluffs developed in the unconsolidated materials are nearly vertical and up to 100 feet high. They were cut by the wave action of Lake Erie and the recession of the shore is continuing. Since about 1810 the section between Port Burwell and Long Point has receded up to 1,200 feet. Recession of the shore at the Houghton Sand Hills appears to have been less, about 600 feet. In many places the bluff has been notched by deep gullies and these are a continuing problem; they take land out of production and are a hazard to existing roads.

CHAPTER 1
LITTLE VALLEYS

1. Introduction

Conservation is basically a state of mind, an attitude, a way of thinking. Reforested areas, flood control dams, wildlife refuges, contour strips and innumerable other things are merely the concrete expressions of that way of thinking. The old and still so generally accepted concept of unlimited use with no thought for the future is opposed to the concept of conservation. Conservation does not mean non-use of our resources, merely good and wise use.

The conservation idea has grown steadily in Ontario and in Canada over the years, in the main because citizens have become concerned over the unwonted exploitation of our resources. They realized that while we must and should use them, we should do so wisely. Unrestricted use of our lands, forests and waters can lead to "slum" conditions equally as bad as any urban slum where buildings and people rot through lack of attention or improper use.

This concern over our resources has led, in Ontario, to the creation of 19 river valley Conservation Authorities, one of which is the Otter Creek Conservation Authority. Individually these Authorities have the task of improving the land, water, forest and wildlife conditions within their valley on a valley scale. During its relatively brief existence the Otter Authority has accomplished a good deal and is to be commended for its effort.

In order to aid the Authority in this matter by describing present conditions and suggesting solutions and methods to follow, the Conservation Branch of the Department of Planning and Development carried out a survey of the valley in 1955. An investigation of land conditions on one of the tributary valleys was made part of this survey.

2. Little Valleys

A small organization is probably almost always more easily managed than a large one and this is certainly true when it comes to the question of improving the lands and waters of a valley. It is particularly true because an attempt of this kind very largely depends on the enthusiasm and co-operation of the individual land-holders. They must come to the realization that what they do on their farm may have far-reaching effects on their **neighbours** downstream. Too-rapid run-off, erosion, and a silt-laden and polluted stream do harm to both and cost money in lower yields, deficient or poor water supply, lost recreational values, and in many other ways.

Most people have positive opinions concerning the city, town, village or township they call home and are justifiably proud of their community and anxious to see it progress and improve. A river valley is another community of which the individual can be proud. He can and does have a direct interest in the stream and the lands which it drains, for his land is a part of the whole.

However, to further the improvement of a valley and to stimulate interest and pride in its lands and waters is often too big a job when the watershed is the size of the Otter Creek. To simplify the task of an Authority and to bring the desired results more rapidly it is often desirable to select one of the tributary valleys for improvement. For this and other reasons, the Branch Creek Valley (it may be better known locally as Sweet Creek) was selected for study. In a smaller valley of this kind co-operation may be achieved more easily because of the smaller number of people involved and because the limits and condition of the area are better known to them.

A program of little valley improvement requires the active support of all the people living within its confines and the improvement of such a valley has a number of advantages.

In the first place the results of such action as is taken can be shown directly, partly in better production from the land and partly in the betterment of the stream which is shared by all. Secondly, the accumulated effect of conservation measures is greater when they are applied on neighbouring properties. Also, as new methods or ideas are introduced they may be applied to an area rather than to isolated farms. Some of these methods may involve the use of techniques and equipment beyond the capacity of the individual but well suited to group effort.

While the ultimate goal is the improvement of the valley as a whole, with every farmer and other land user co-operating with the Authority in its efforts, the success or failure of the project depends on the individual farmer. He is the one responsible for the improvement of his own farm. He is also the one who has to cope with the unique conditions found on his farm. Nevertheless, the responsibility for initiating and furthering the plan belongs to the Authority. It can contribute a great deal by helping to bring to the farmer the information he needs to help him grow better crops and improve the condition of his land.

Land improvement does not necessarily entail the use of costly machinery or of expensive installations which would be beyond the economic capacity of the average farmer. Most farmers have at hand nearly all the machinery they would require for most works. Many conservation measures such as contour tillage, require only a different method of operation from that habitually used, or an increased emphasis such as increased use of fertilizer, or the clipping of pastures on the one already practised. One of the major problems of the valley is that of drainage. Studies have shown that the expense involved in improvement is usually recouped within two or three years and that substantial gains in yields result.

Although it may be conceded by the farmer that conservation is a good idea it will fail to take hold unless the farmer can see direct benefit. It has been proven that applied conservation measures do pay, particularly after they have been in use for a year or so. Not only does the land produce more at lower unit cost but the run-off is controlled, the structure of the soil is improved and erosion is reduced. Under lack of control these things actually cost him money. For instance, one study, made using a variety of implements in a considerable number of tests, revealed that contour cultivation resulted in average time savings of nearly 13 per cent and fuel savings of over 9 per cent as compared to uphill-downhill cultivation. Savings such as these are not to be ignored, particularly when the cost of conversion to such a system may be small. On the Branch Creek a good deal of the land is suited to many of the simpler measures. The main need is a desire on the part of the farmer to do things the better way.

Earlier it was mentioned that the individual farmer's co-operation was essential in the reformation of a watershed. The start of such a program would be the improvement of the farm and this may be done using a farm plan. In many ways the farm is like a small watershed and the practices applicable to one are equally applicable to the other. Under a farm plan the land is surveyed and rated according to its ability to produce and a plan of use established which meets the needs of the farmer. At the present time no farm in the valley has been planned*. The question of farm planning is dealt with more fully later and is one with which the Authority should concern itself.

* Farms are planned by the Soil Advisory Service, Department of Soils, Ontario Agricultural College, Guelph. Information and application may be made through the County Agricultural Representative.

3. Soil and Water Conservation

Soil and water conservation has been defined as "the use of every acre according to its capability and its management according to its need". Experience is often a good teacher and in a general way this is followed in ordinary farm practice. Excessively hilly and steep land or wet land is often uncultivable economically. In such cases unimproved pasture or forest is often the only possible use. This land may, then, be used according to its capability although its management may often leave something to be desired.

The same is true of the cultivable lands and a determination of their capability is important and necessary. Not all land which can be easily cultivated is suited to all crops, both from the point of view of yields and erosion. On the Branch Creek nearly 95 per cent of the land has been considered capable of sustained cultivation but less than 2 per cent of it is capable of being used without restriction in its present condition. Some of the land, with adequate drainage, can be considered the equivalent of Class I land and used to capacity without other special measures. Most of the sloping land will always be subject to use restrictions if no damage to the land is to result.

The purpose of a soil conservation project is to adapt the use of the land to its natural capabilities and to undertake measures which will check soil erosion and accelerated run-off of water, in order to maintain the soil in good condition and production at a high level. The real job of conservation farming is to make part of the farmer's routine all the practices necessary to preserve, improve and make good use of his soil.

4. The Branch Creek Drainage Area

The Branch Creek is a small tributary of the Otter Creek which it joins at Otterville. It runs in a south-east direction to this point for a distance of about 6 miles.

The area drained by the stream is about 7,340 acres and lies within the townships of North and South Norwich in the County of Oxford. The next nearest settlement of any size is that of Norwich which lies to the east of the watershed a distance of about 1 mile.

The watershed is well served by roads and a rail-line connecting Norwich and Tillsonburg crosses it.

Most of the creek is dry for part of the summer or dries to standing pools. Only in its lower reaches is permanent flowing water found and this may result, in part, from the sandy soils found here. A considerable section of the main stream and many of the tributaries have been converted into open drains by cleaning and straightening. These are a common and necessary landscape feature associated with the imperfectly and poorly drained soils of much of the till plain.

5. How the Valley Was Surveyed

During 1955 several crews were engaged in the survey of the valley. Each crew was allotted a portion of the watershed and all the land was covered on foot with visits being made to every field.

During the survey a number of observations were recorded, the data being plotted on air photographs of the area. These show the field pattern, the field boundaries, extent of woodlot and so on, and their use greatly facilitates survey work of this nature. All land uses for the crop season of 1955 were recorded on the photographs by means of appropriate symbols. In the same manner physical land conditions were mapped to a minimum of four acres. These included the delimiting of soil types, an estimation of erosion, the slope of the land, the degree of stoniness or boulderiness, and the extent and size of gullies. The location of waterbodies, watercourses, springs, seepage areas and drainage ditches were noted.

During the survey many farmers and others were interviewed with the object of obtaining more complete information on questions of land use and soil problems and soil capabilities.

With the completion of the survey the information obtained was transferred from the air photographs to vellums and the various acreages assessed by planimetering. From the data gathered regarding present land use and physical land conditions the capability of the land was appraised. This is expressed in the map of Recommended Use which accompanies this report.

CHAPTER 2

PHYSICAL LAND CONDITIONS

1. Introduction

It is needless at this point to pursue in lengthy fashion all of the questions concerning climate, geology and physiography as they relate to the Branch Creek Watershed. A few remarks on the physiography of the little valley may be made, however, for this has bearing on the use of the land, water supply and other matters.

2. Physiography

The bulk of the watershed lies in an area of till plain in which the soils are fairly heavy, rather stone-free and, over a large acreage, suffer impeded drainage. There are a number of irregularly-shaped, low-lying areas where drainage is poor. Some of these low areas contain small deposits of muck. The largest area of muck to be found on the watershed lies at the headwaters in the northern portion of the till plain. The muck is up to 4 feet deep and presumably resulted from a fairly long ponding of water backed up in a hollow behind the moraine. This muck area is now drained by Branch Creek and in the summer of 1955 was dry to the bottom.

In general the landscape of the plain is gentle and the slopes are long and smooth or mildly hummocky. Doubtless the surface till at least has been created out of the stonefree, heavy lacustrine sediments which the Erie ice lobe worked over prior to the formation of the sand plain. Varved silty clays and clays may be seen along the edge of the till plain underneath the sands north of Otterville. It seems probable that varved sediments underly at least portions of the surface till of the till plain. If so, these heavy sub-layers might have an adverse effect on soil drainage*.

* Varves - stratified, waterlaid clay, sometimes silty or with more silty layers. They have been considered as representing annual layers of soil material in the same way as tree rings represent annual layers of wood.

The Norwich moraine runs more or less east-west across the watershed and bisects the till plain in this area. The local topography is rougher than that of the till plain but not excessively so. The greatest topographic break is found where the Branch Creek cuts across it and the valley here is quite large and deep. It would be difficult to say whether this is completely an excavation of the Branch Creek or simply an expansion of a trough through the moraine by the stream. In general the soil materials are somewhat lighter than those of the till plain. The medium-textured Guelph soils are common here but there is also some Huron. The soils are also stonier. Dairying is the main pursuit and there is little cash cropping apart, perhaps, from grain corn.

The Branch Creek Valley is largely outside of the sand plain but the lower rim of the watershed lies within it. Some of the sand is a thin veneer a few inches to a couple of feet thick, and a good deal of it is imperfectly to poorly drained. Where the sand is deep the soil drainage is usually good to excessive. Tobacco growing has entered the watershed on the better drained land near Otterville.

3. Soils

(a) The Soil Profile

There is infinite variety in soil and a very large number of types may be recognized. As our knowledge of soil grows there is a tendency for the types recognized to increase in number. Each soil recognized has certain identifiable characteristics which set it apart from others.

Soils are classified and mapped on the basis of these natural characteristics, which may include such things as the number of horizons in the profile and the colour, texture, structure, organic content and reaction of each. Among other things the nature of the subsoil and the degree of stoniness or boulderiness will also be considered.

A soil develops out of the original parent materials and the type resulting depends on the inherent characteristics of these materials, on the climate, surface slope, and the surface and subsurface flora and fauna. Other factors may also be of importance. In any single instance all of these factors operate together and interlock in such a way that, if undisturbed or unchanged to any marked extent, they produce, in time, a soil possessing certain recognizable characteristics. Because the conditions which operate to create them are dynamic, soil profiles, and consequently the soils themselves, are constantly changing. Usually these conditions change slowly and so the soils themselves change equally slowly.

If a vertical cut is made to a depth of three or four feet through the soil it will be seen that the cross-section is marked by a layering, each layer, or HORIZON, possessing certain characteristics of colour, texture, structure, organic content, and acid reaction. Together these horizons make up the soil PROFILE. The depth of the profile is variable, in some soils a foot or less and in others several or many feet. On the Branch Creek Watershed the profiles are usually about two feet or less in depth. In the moraine they may be somewhat deeper and in the sands, particularly those which are well drained, somewhat deeper still. The Fox may be three feet or more to the bottom of the B horizon.

Depending on drainage conditions several distinct types of profile may be found. The following is a generalized description of a virgin, well drained Gray-Brown Podzolic soil such as might be found in an old woodlot or along a fenceline in the Branch Creek Watershed.

HORIZON

- A₀ - Partially decomposed litter from deciduous trees.
- A₁ - Dark grayish-brown to very dark brown mineralized humus layer - loose and friable and slightly acid in reaction.
- A₂ - The leached horizon, yellowish to yellowish-brown to gray in colour. The iron, lime, organic matter and clay have been washed out and the reaction is acid.
- B - The horizon of accumulation, containing a high proportion of clay and sesqui-oxides. Usually the colour is dark or reddish-brown while the structure is blocky or nutlike. In reaction it is usually neutral to slightly acid but the lower portion of the horizon may contain some free carbonates.
- C - The unweathered, calcareous parent material, usually gray or brownish-gray in colour.

In no case are the horizons separated one from the other by a sharp break; there is always a transition zone in some cases greater than in others.

Profile complexity also varies. In some soils not all horizons are represented, or they may be poorly developed. Also, the horizons may vary considerably from soil to soil in thickness, some have a thin A₂, some have a thick A₂, and so on.

When speaking of the soil horizons the A is considered to be the topsoil, the B the subsoil, and the C the parent material. In a poorly drained soil such as the Brookston, or the Parkhill, the A₂ and B horizons may be missing or poorly developed and a G (Glei) horizon exhibited. The latter is often blue or bluey-gray in colour and marked by rusty mottling.

As plant material decays it is gradually incorporated into the upper part of the soil by the action of earthworms, micro-organisms and other means. During this process acids are formed and partly as a result of these lime, iron, clay colloids and organic matter are leached out and carried downward to be redeposited, in part, in the B horizon. The B horizon thus has a rather high clay content and is dark brown to reddish-brown in colour. Depending on their thickness several horizons may be mixed together when cultivated to form an A_c (cultivated) horizon.

Under conditions of a fluctuating water-table near the surface a soil may be considered to be imperfectly drained. Such a soil may possess a thicker A_1 horizon and at the same time the A_2 or leached horizon may be less well developed. Field identification is aided by the mottling (rusty streaks and patches) which appears in the lower part of the A_2 , and in the B horizons. The Perth clay loam is an example of such a soil.

In addition to the Gray-Brown Podzolic (e.g. Huron and Perth) and the Dark-Gray Gleizolic (e.g. Brookston), two other soils are to be found on the watershed: muck and bottomland.

In the case of the muck the drainage has been so poor for so long that normal profile development has not taken place. The muck, found chiefly at the headwaters of the stream, is black in colour, woody and up to four feet deep.

Bottomland, a land type consisting of soils made up of alluvium, is found along the stream courses where periodic inundation takes place. This flooding leads to the creation and deposition of various mixtures of sand, silt, clay and gravel. Soil drainage is usually imperfect to poor and soil profile development is often non-existent.

(b) The Soils of the Watershed

Nearly all of the soil materials in the watershed were laid down during the period of the last ice age. These parent materials consist chiefly of heavy till but there is also some acreage of medium till and, of course, of sand.

A group of soils developed on the same type of parent material and possessing similar horizon development and characteristics is classed as a soil series. Type differentiation within a series is based on the texture of the surface soil. There is thus a Huron clay loam and a Huron silt loam. Huron indicates the soil series and, with the exception of the texture of the surface soil, these two soil types have the same differentiating characteristics.

Where soils have developed on similar parent materials but differ in profile characteristics due to drainage or relief, then classification may be done on the basis of the catena. In terms of drainage there may thus be three series in the catena: the well drained, the imperfectly drained, and the poorly drained. In the Huron catena the Huron series is the well drained member, the Perth series the imperfectly drained member, and the Brookston series the poorly drained member. All of these catenary members are found on the watershed. For convenience a catena is usually identified by the name of the well drained member.

The largest acreage of soils in the watershed belongs to the Huron catena; in fact, these soils occupy about 4,300 acres, or 59 per cent of the area. A large part of the balance is taken up by the soils of the Guelph catena, the Fox catena, the Bookton catena, and muck and bottomland. Table I summarizes the situation found on the survey.

There is little need, at this point, to examine or describe in detail the profiles for all the various soils. There has been no soil report published for Oxford County

A well developed Fox profile near Otterville. The A2 horizon is the broad, light-coloured band running between the darker A1 and B horizons.



Gullies cut back through the stream bank in many places. Areas such as this should be fenced and reforested.

but the Huron and Guelph soils are described in the Perth County Report and the Bookton and Fox soils in the York County Report. Copies of these reports may be obtained free of charge through the County Agricultural Representative.

For the most part there is little difference to be found between the Huron and Perth soils and under certain conditions there may be difficulty in distinguishing between them. Normally the topography of the Perth is gentler than for the Huron and the incidence of erosion less. The Perth profile, too, is somewhat shallower and less well developed than that of the Huron; and the horizons are thinner, except for the A_1 which tends to be slightly thicker, perhaps as a result of gentler terrain and restricted drainage. In certain other respects also these two profiles are much alike.

The chief difference between the two lies, as already mentioned, in the question of soil drainage. In this respect the Perth is classed as imperfect and close examination of the profile discloses mottling, due to a high and fluctuating water table, in the A_2 and B horizons. This mottling is displayed in the form of rusty streaks and blotches.

The Huron soils are fairly productive and under natural conditions are better for most field crops than the Perth. The adaptability of the Perth soils is greatly improved when adequate tile drainage is installed, at which time they are nearly equal in productivity to the Huron. An advantage of the Perth, as already mentioned, is a lower susceptibility to erosion.

Because of the rather gentle terrain there is an absence of road cuts in the area sufficiently deep that good soil profiles may be obtained. Some of the best examples were found along fencerows where cultivation has never taken place; these were examined using an auger and/or spade.

Soils			Soil Drainage	Parent Material	Acres	Total Acres	Per Cent	Total Per Cent
Catena	Series	Type						
Huron	Huron	Clay loam	Good	Heavy Glacial Till, Low in Stone	265		3.6	
	Perth	Clay Loam	Imperfect Poor		3,995		54.4	
	Brookston	Clay Loam			37	4,297	.5	58.5
Guelph	Guelph	Loam	Good	Medium Glacial Till,	504		6.9	
	Listowel	Loam	Imperfect Poor	Mildly to Mod- erately stoney	1,639		22.2	
	Parkhill	Loam			21	2,164	.3	29.4
Fox	Fox	Sand	Good	Well Sorted, Coarse Textured Outwash Sand	202		2.7	
	Brady	Sand	Imperfect Poor	May be some Gravel	401		5.5	
	Granby	Sand			41	644	.6	8.8
Bookton	Berrien	Sandy Loam	Imperfect	Coarse Textured Outwash Sand, Shallow (to 3 ft.) over clay	15	15	.2	.2
Muck	Varying thicknesses of organic soil over clay, silt or sand - may be woody or not, depending on source vegetation - drainage poor.				96	96	1.4	1.4
Bottomland	Often flooded - no profile development - variable composition of sand, silt or clay and gravel - drainage usually imperfect to poor.				126	126	1.7	1.7
Totals						7,342		100.0

Although there is some differentiation in profile development from place to place, particularly in depth of profile, the following brief description of the Huron clay loam may be taken as typical.

The Huron is only a moderately deep soil and the calcareous, light brown to gray-brown clay till is reached at a depth of from 17 to 25 inches. The till tends to be rather massive and hard and may be only slightly stony to quite stony. The A_1 horizon, the humus-rich layer, is quite dark in colour, friable, and very nearly stonefree to stonefree; it may be up to 5 inches in thickness. The underlying A_2 horizon may be up to twice as thick and is somewhat yellowish-brown in colour; it is normally stonefree. The B horizon is a hard, blocky-structured clay and very nearly stonefree. The A_1 and A_2 horizons are very slightly acid in reaction. The soil is typical of the Gray-Brown Podzolics. There are some very small areas of the silty phase but these were not distinguished.

The Brookston clay loam belongs to the Dark Gray Gleisolic group of soils and is the poorly drained member of the Huron catena. Typically, the Brookston topography is quite level and erosion is negligible. On the watershed the soil is found chiefly in depressional areas. The very small areas of Brookston were not mapped and consequently do not enter into the totals for this soil as in Table I. Under normal conditions management of this soil may be difficult but drainage greatly improves its capability.

The A_1 horizon of the Brookston is deeper than in the other two members of the catena and may reach a depth of up to 10 inches; normally the horizon is a little thinner than this. It is a friable black clay loam and is usually stonefree. The glei horizon underlies the A_1 , and the bottom may be 12 to 14 inches below the surface. It is gray-brown in colour, almost olive at times, and is hard and

tough, or sticky, according to moisture conditions. The parent material is a calcareous, slightly to fairly stony clay till.

The Guelph soils have developed on gray-coloured, calcareous, stony till. The imperfectly drained member has been named London and the poorly drained member Parkhill. The parent material is considered to be medium textured and profile development of the well drained member tends to be slightly deeper than in the Huron. So far as crop adaptability is concerned both soils are about equal. The same is true of the Perth and London. The Parkhill is not as good as the Brookston.

The Perth County Soil Report describes the Guelph loam as follows:

- A₀ - Accumulated layer of partially decomposed litter from deciduous trees.
- A₁ - 0 - 4 inches dark grayish brown (10 YR 4/2) loam; fine granular structure; friable consistency; slightly stony; pH - 6.9.
- A₂₁ - 4 - 12 inches pale brown (10 YR 6/3) loam; fine platy structure; very friable consistency; slightly stony.
- A₂₂ - 12 - 14 inches gray (10 YR 6/1) loam; fine platy structure; friable consistency; stonefree; pH - 6.6.
- B - 14 - 24 inches brown (10 YR 5/3) clay loam; medium nuciform structure; hard consistency; few to frequent stones; pH - 7.0.
- C - Light gray (10 YR 7/2) loam till; medium nuciform structure; hard consistency; moderately stony; boulders vary from few to frequent; calcareous; pH - 7.8.

On the watershed these soils are used chiefly for dairying and general farming and most of the land is cleared. The Guelph loam is subject to serious erosion unless well managed while the chief hazard on the London and Parkhill is restricted drainage. A considerable amount of tile drainage was being carried out in the fall of 1955. In general erosion is not serious and this probably reflects in part, the extensive use of permanent grass and the large amounts of manure available from the dairy herds.

The Fox soils have a well developed profile which may be up to 36 inches, or more, to the bottom of the B horizon. The B horizon is quite distinct but may be variable in thickness. The Fox itself is well drained due to the open nature of the sands and for many crops may be too droughty unless irrigated. It also tends to be low in natural fertility.

The largest acreage of sand on the watershed is the Brady soil, the imperfectly drained member of the Fox catena. Drainage has so far restricted tobacco growing and this part of the watershed is not considered good dairy or general farm land. At many points the Brady verges on the Berrien, a sandy, imperfectly drained soil with clay at about 3 feet or less below the surface.

The mucks are the result of poor drainage conditions operating over a long period of time. These conditions have prevented the complete decomposition of the organic debris, with the result that it has accumulated over the years. The muck is quite dark in colour, may be alkaline or acid depending on the nature of the waters draining into it, and may be several feet thick. The underlying mineral material is variable but sand and clay are common. The land use is woodlot or scrub.

Bottomland has been discussed to some extent previously but it should be noted that depending on the width of the section in question it was sometimes found necessary to include, for mapping purposes, the adjacent valley slopes. This was made necessary by the scale of mapping and has some bearing on the recommendations found on the map accompanying this report.

(c) Soil Erosion

Many people are possessed of the misconception that erosion of the land, that is, the translocation of soil materials from place to place by the natural forces of wind or water, can be stopped completely. This is impossible except,



Short, steep slopes and irregular topography are found on the moraine. Winter cover crops, extended rotations and grass will help control erosion on land like this.



The till plain is marked by gently sloping land and restricted drainage and sheet erosion can be serious. Rotations and contour tillage can provide effective erosion control.

perhaps, over small areas, for relatively short periods of time, and under certain conditions. Through the ages erosion of the land has taken place, moulding it into the scenery we see today. Under natural conditions this erosion is a very slow process and long years are required to alter the landscape appreciably. We call this form of erosion "geologic" erosion.

Under natural conditions the face of the earth is masked by a cover of vegetation and it is this cover which is chiefly instrumental in retarding run-off and slowing down erosion by wind and water. Because of the slow rate of erosion the soil, as seen in the profile, is not greatly affected by it and the process of soil building is easily maintained. While conditions remain more or less the same the loss of a fragment of surface soil is offset by an increment from below as the parent material weathers and is incorporated into the soil. Under conditions such as this nature is, by and large, in balance.

When the land is cleared for cultivation or used for grazing, however, this picture may be greatly changed; the protecting cover of vegetation is removed or reduced; cultivation may be carried on up and down the slope and surface water enabled to flow over the land more easily; the structure of the soil changed for the worse and organic content lessened with the result that the soil's moisture absorptive capacity is impaired. All of these changes can easily produce, in a rather short time, a less productive or even a ruined soil.

Such erosion is called induced or "accelerated" erosion. It is this erosion that the Conservationist is concerned about and which every farmer should be aware of.

Some soils erode more readily than others and the same soils under different forms of land use may show vastly different amounts of erosion. There are also other factors which affect the rate of erosion: surface slope,

topography, intensity of land use, rate of rainfall and the physical condition of the soil. For these and other reasons a farm plan based on conditions peculiar to the individual farm is desirable to control erosion.

The removal of soil by erosion is accomplished by wind and water; the former is of importance in Ontario in only a few areas, chiefly those of light soils. Erosion by water is much more widespread although, as intimated, it is more damaging on some soils than on others.

When the surface run-off is concentrated into channels which are unprotected or inadequately protected gullies may develop. This is the most spectacular form of erosion in Ontario and a gully can grow quickly to the detriment of the land and the farmer. Fortunately this form of erosion is not common on the present watershed but some gullies are cutting back through streambanks. Run-off channelled in an unprotected field, unprotected tile drain outlets, and channels formed through cattle always using the same path are among the contributing factors leading to gully erosion.

At the start a gully may be insignificant but it can become large very rapidly. Small rills which are found on the slope of a cultivated field after a heavy rain and which can be covered over at the first cultivation are danger signals every farmer should heed.

Sheet erosion is much less spectacular but is dangerous because it is so widespread and most often goes unnoticed. This form of erosion usually takes place relatively slowly, but a whole field may be affected, with the result that the humus-rich portion of the soil, together with its store of available nutrients, is removed. Much of this erosion takes place during summer storms, just at a time when crops need the moisture which is flowing over the surface of the land into the streams. A reduction in the run-off would thus

prove directly useful in at least two ways: reduced erosion and increased moisture supply for crops.

Many measures may be adopted to control run-off and reduce erosion. Land kept under a permanent cover of grass or trees and properly managed may erode very little. The same may be true on level lands regardless of the form of use, although, of course, the land may become less productive unless soil management practices are adequate. Soil-building rotations, the use of cover crops and fertilizers, contour tillage and grassed waterways are among the measures that may be used.

(d) The Estimation of Erosion

There are a number of ways of determining whether erosion has taken place and the amount. The effect of erosion may often be easily seen in poor crop response due to drought. On slopes or knolls where the A and/or B horizons have been removed, the soil is less able to absorb moisture, and the crop may be thin and weak. Where erosion has been severe, the grayish parent material may be seen at the surface. A patch with an excessively stony surface may also be a sign of severe erosion and reflect the removal of the finer soil constituents. Erosion of this severity is relatively rare on the watershed.

Where observations such as this may be made, other evidence is also usually available: sediment may be seen to have accumulated at the bottom of a slope; soil may accumulate on the uphill side of a fencerow, while the downhill side is cut away.

To get a more certain determination of the degree of erosion the soil profile must be examined. It is usually possible to find a good profile of a virgin or nearly undisturbed soil in woodlots and along old fencerows. Such a profile may, for instance, exhibit one foot of topsoil (A_1 and A_2) and two feet of subsoil (B). On an adjacent cultivated slope of the same soil type and on which erosion is suspected, there may be only 6 inches of topsoil over the subsoil. In such a case it would be fair to assume that

something like 6 inches of topsoil had been eroded away. In another case one might find the subsoil exposed at the surface and the parent material at a depth of only 12 inches. All of the topsoil and one half of the subsoil, something like 2 feet of material, would thus have been removed.

If the recognition of horizons by colour or texture is difficult, a simple chemical test can be used to aid in erosion estimation. A dilute solution of hydrochloric acid produces an effervescence when applied to soil containing free carbonates. In the imaginary virgin profile mentioned above a fizz would be obtained at 3 feet at the start of the lime-rich-parent material. On the severely eroded site the same result would be obtained at 1 foot. If the surface soil effervesced it would indicate that all of the topsoil and subsoil had been removed. A note of caution should be made, however, in that some soils may be found where other horizons naturally possess sufficient free carbonates to produce a reaction.

(e) Soil Erosion on the Watershed

Because of the overall gentle topography, and partly because of a fairly heavy emphasis on grass as a form of land use, soil erosion on the watershed is not as severe as it might otherwise be. The strong development of dairying and the large amounts of manure provided have undoubtedly served to slow down erosion and at the same time maintain the soil organic content. The following tables show the acreages of the several watershed soils as they have been eroded, and also the acreages of the watershed classed according to slope. The latter table is self-explanatory but the information contained therein underlines the remarks made previously regarding the topography of the area and also bears relation to the degree of erosion found.

Ninety-six acres were classed as muck and 126 acres as bottomland. No attempt was made to estimate erosion for these types and in many cases they were receiving material eroded from surrounding slopes rather than losing it.

It must be remembered that the data in this table represent average conditions. There are many small areas where erosion is more or less severe; at the scale of mapping these were too small to be included. It should also be remembered that, in the above classification, the amount of material removed will vary from soil to soil. One-third of the topsoil removed from one soil may involve much less material than one-third from another soil because of the differences in depth of profile and thickness of horizons.

(f) Soil and Surface Drainage

The lack of adequate soil drainage is one of the most important features of the area and a large area is affected. To gain relief so that the land may be worked more easily and a better yield obtained it is essential that such land be drained artificially. To a considerable extent this has been done and there are numerous open drains and tile underdrains. An expansion of this program is indicated, and is taking place, except on land where the cost of draining would be out of proportion to the benefit gained.

It is unfortunate indeed that the act of draining the land for crop improvement should lead to a greater deterioration of stream flow with respect to suitability for fish and, perhaps, for recreation. Because agriculture is and will continue to be the major form of land use in this area and because there will be an added emphasis on drainage in the years to come, there is perhaps little that can be done to improve stream flows to the point of providing a more suitable stream habitat for fish. The net result of more and more efficient tile and open drains will be to deliver water off the land at a faster rate.

The inability of crops to grow and produce on land with restricted drainage is due primarily to two things. In the first place the crops grown in the watershed are constitutionally unable to grow in water or in a water-logged soil. Secondly, although seeds may germinate, the roots develop and

the plants begin to grow in the drier zone above the water-table, their later growth may be restricted by drought. This is because the plants cannot root deeply in the early, wetter part of the season. As the drier, hotter summer comes on the water table drops, sometimes quite rapidly, and the crop is starved for water because of the shallow root development. Too, the heavy soils, such as the Perth and Brookston, become hard and resist root penetration as they dry out,

TABLE II
SOIL TYPE AND EROSION *

Soil Type	Degree of Erosion (Acres)				Total Acres	Per Cent
	0	1	2	3		
on Clay Loam	-	261	4	-	265	3.7
th Clay Loam	57	3,824	108	6	3,995	56.2
okston Clay Loam	20	17	-	-	37	.5
lph Loam	-	335	132	37	504	7.1
don Loam	65	1,477	81	16	1,639	23.0
khill Loam	21	-	-	-	21	.3
Sand	-	159	43	-	202	2.8
dy Sand	-	401	-	-	401	5.6
nby Sand	-	41	-	-	41	.6
rien Sandy Loam	-	8	7	-	15	.2
al	163	6,523	375	59	7,120	
otal	2.3	91.6	5.3	.8		100.0

Muck and bottomland not included.

Degrees of Erosion

- 0 - No significant erosion
- 1 - Less than 1/3 topsoil removed
- 2 - 1/3-2/3 topsoil removed
- 3 - 2/3 topsoil and less than 1/3
subsoil removed

TABLE III
SLOPE AND EROSION

Slope Group	Erosion Acres				Total Acres	Per Cent
	0	1	2	3		
A	103	2,575	14	-	2,692	37.9
B	16	1,691	108	6	1,821	25.5
C	-	69	117	37	223	3.1
G	-	-	43	-	43	.6
M	44	2,169	12	-	2,225	31.3
N	-	19	29	16	64	.9
P	-	-	52	-	52	.7
Total Acres	163	6,523	375	59	7,120	
Per Cent	2.3	91.6	5.3	.8		100.0

SLOPE GROUPS

Hummocky Topography

A - 0- 2 per cent
 B - 2- 6 " "
 C - 6-10 " "
 D - 10-15 " "
 E - 15-20 " "
 F - 20-30 " "
 G - 30+ " "

M - 0- 7 per cent
 N - 7-15 " "
 P - 15-25 " "
 R - 25+ " "

CHAPTER 3

LAND USE

For perhaps one hundred years dairying has been the chief agricultural pursuit over most of the Branch Creek Watershed. In the beginning the family supplied its own requirements of dairy products but excess production soon found its way to market. By 1850 much of the surplus milk was being converted into butter and cheese, both of which were made at home. At this date Oxford County was producing cheese in fairly large quantities. The home product generally proved to be commercially unsatisfactory, however, and in 1864 the first cheese factory in British North America was established in Norwich. The number of cheese factories increased rapidly throughout the country and a fair share of them were in Oxford County. Thus the dairy farmer had an established market for the product from his herd.

The climate and soils of the County were well suited to dairying and once established the industry persisted. The County is now one of the two chief dairy areas of the province but the emphasis has shifted from cheese to whole milk. Much of the Branch Creek production is shipped to Toronto.

There is little doubt that the long association with dairying has helped to maintain the soils of the watershed. Improvement and expansion of the herds has resulted in the production of more manure for the fields and has produced an emphasis on good pasture. Most of the pasture is improved but some, particularly that in the bottomlands, remains unimproved because of the natural land conditions.

Although most farmers are engaged primarily in dairying, a considerable number have devoted all or part of their land to special crops. Tobacco is the most important of these and in 1955 248 acres were being used for this crop. Its growth is restricted entirely to the southern portion of the watershed where are found the sands suited to its

production. The next most important crop is millet which is grown for bird seed. One farm accounts for about half the acreage. The millet, white beans, soy beans, peas, sugar beets and turnips are all produced on the heavier soils. The commercial orchards are also on these soils.

In terms of acreage the chief crops on the watershed are hay, pasture, grain and corn. There is some grain corn but most of this crop is used for ensilage. There is nearly three times the acreage in spring grain as compared to winter grain and over half the grain acreage produces oats. The next important crop is winter wheat followed by oats - barley. Winter rye is largely confined to the tobacco land where it is important in the rotation as a cover crop and manure crop for maintaining the soil organic content. Rye is the most widely used rotation crop in the tobacco lands of the Norfolk sand plain. It is sometimes used preceding corn.

Only 9.4 per cent of the land is in forest or scrub and the bulk of it is being pastured. A pastured woodlot is neither good pasture nor a good woodlot. A good woodlot is an asset to any farm and plays an important part in soil and water conservation in a valley. A good woodlot can provide a cash income on a sustaining basis, provides a good habitat for wildlife, may provide fuel and fenceposts, and aids in the control of water. The Ontario Royal Commission on Forestry (1947) reported that "... not more than 10 per cent (of the woodlots in Ontario) could possibly be classified as good forest". It also reported that rarely have Crown lands exhibited such poor forestry methods, or so little thought or consideration of the future, as is to-day exhibited on more than 75 per cent of the farm woodlots throughout the Province. There is indeed much that can be done to improve the private woodlots of the watershed.

The following table summarizes the present land use of the watershed.

TABLE 4
PRESENT LAND USE

Land Use	Acres	Total Acres	Per Cent
Hay	972	972	13.3
Improved Pasture	1,353	1,660	22.6
Unimproved Pasture	307		
Grain - Spring	1,462	2,008	27.2
- Winter	546		
Intertilled Crops		1,478	20.2
Corn	1,035		
Tobacco	248		
Turnips	94		
Sugar Beet	36		
Peas	35		
Soy Beans	19		
White Beans	7		
Potatoes	4		
Millett	206	532	7.3
Orchards	57		
Market Garden	22		
Idle	82		
Farmsteads, Etc.	165		
Forest - Pastured	541	691	9.4
- Not Pastured	109		
Forest Scrub - Pastured	41		
Totals		7,341	100.00

Nearly one thousand cattle were counted over the watershed and all of them were in dairy herds. Holsteins proved most popular, forming over 80 per cent of the whole. The balance were Jersey, Guernsey, Ayrshire, and mixed in that

order. No sheep were seen and no attempt was made to estimate the swine or poultry populations although both are important in the economy.

During the survey it was found that approximately 30 per cent of the cropland is devoted to the soil building crops less than 40 per cent of the time. Thus, while most of the land is being fairly well managed so far as organic material replacement by crop residue is concerned, a tangible proportion is being used probably too intensively. The application of barnyard manure in quantity is a decided aid in maintaining soil fertility but some of the land receives little of this, and of sod crops, because of the emphasis on cash cropping. By and large, however, the land is being well managed.

In addition to rye as a cover and manure crop, especially on the tobacco farms, wheat, sweet clover, and heavy hay crops have also been used for these purposes. Barnyard manure is generally applied every 4 or 5 years, often as a top dressing preceding corn but also before wheat. It was also reported that new seedings of hay were sometimes manured.

Every farmer on the watershed is interested in having good crops and to this end uses a considerable amount of commercial fertilizers. Those farmers who make use of soil tests have the work done by the fertilizer plant near Norwich. None, apparently, use the facilities of the O.A.C. at Guelph. The fertilizer commonly used is 2-12-10 but the rate of application appears to be slightly less than the general recommendation of the Advisory Fertilizer Board. Oats appears to receive approximately 200 lbs per acre application, wheat slightly more, and corn 200-250 lbs. Millet is treated about the same as oats while tobacco uses 1,000 lbs. or more. Some of the corn gets 10-10-10 at a rate of 200-300 lbs. per acre. In some cases 5-10-13 is used on this crop.



Good sod crops build and protect the soil and help produce quality herds.



The level, well-drained sands produce top-quality tobacco but require special cultivation practices to maintain fertility and reduce the risk of wind erosion.

No matter how much fertilizer is used it should be remembered that it is an aid, not an answer. For good crops the soil itself must be kept in good condition and for this a high organic content is a requisite. Indeed, the value of fertilizer is enhanced when the organic content of the soil is maintained.

Most of the watershed suffers from poor or imperfect soil drainage and on most farms, if not all, some attempt has been made to improve the condition. A considerable amount of tile drainage has been installed and a number of ditches have been built. Some of these are merely an improvement of existing watercourses. It is interesting to note that a full half, the northern portion, of the main stream has been improved as a municipal drain, both ditch and large tile.

Much of the tile drainage system laid in the past is too small (3 inches diameter) and many drains are functioning poorly or not at all. The need for tile drainage is appreciated probably more than any other conservation measure and many farmers have planned a drainage program. During August a ditcher and crew operated on the watershed, laying drains on several farms. A considerable acreage still needs this improvement.

At the present time there are 86 farms wholly or partly within the watershed and about 80 of these are engaged primarily in dairying. These holdings range in size from 25 acres or less to over 250 acres. Most are about 100 acres in size. In line with the general trend in Ontario it may be expected that the future will see fewer farms of larger size. There may be a greater lag here, however, than in those areas where the soils are less productive. The soils of the area are eminently suited to dairying and it is anticipated that this will continue to be the main endeavour. Cash cropping is important and may become more important in the future. These matters should be kept in mind with

reference to any program relating to land improvement which the Authority might implement. In this regard it should be remembered that the watershed contains, basically, two distinct types of soil and three classes of land use and that these will have a bearing on the program followed.

Lately there has been an influx of Amish Mennonites into the watershed from Ohio. Several farms have been purchased by these people and it is likely that more will move into the area in time. In other parts of Ontario where this sect has congregated the result has generally been highly favourable in so far as the effect on land is concerned. They are good farmers and normally handle the land well.

CHAPTER 4

LAND CAPABILITY AND RECOMMENDED LAND USE

1. Land Capability

Before land may be planned for use in a program of soil and water conservation, it is necessary first to classify it in terms of its use capability. Only by deciding the capability of the land for its proposed use can we be sure of using each acre according to its capability and managing it according to its needs. To get the most out of the land on a long term basis the appropriate crops, commensurate with need, should be grown, and good tillage methods adopted. We aim at retaining or improving soil fertility, tilth and organic content, and decreasing water run-off and soil erosion by improving the water absorptive capacity of the soil.

The classification of land for use depends on a number of things, including the use to which the land is to be put. The classification of land for, say, recreational or industrial purposes will require different criteria than for agriculture although some of the factors involved may be common to each. With reference to agriculture it is necessary to know, for any particular place, the type of soil to be found there, the slope of the land, the degree of erosion, the state of soil drainage and the existence of gullies, stone-piles and stone fences. The present use of the land, the existence of drainage schemes, the climate and the history of land use, among other things, should also be known. Unfortunately, the same detail of information is not always available for each item but an effort is made to get as much as possible.*

* Additional information is also obtained from the County Soils Reports and maps of the Ontario Soils Survey, and from other publications of the Ontario Department of Agriculture and Ontario Agricultural College.

In classifying the lands of the Branch Creek Watershed, also, several questions were kept in mind:

(a) was the land suited to the production of crops found there and if so could it be tilled without the risk of erosion.

(b) if erosion was a restricting factor, how great a risk was entailed in devoting the land to continued cultivation.

(c) was the land capable of being used for cultivation only part of the time with minimum risk.

(d) was continued use limited to the production of permanent vegetation, and if so should the cover be grass or forest.

(e) how suitable was the land for the production of intertilled cash crops.

The capability of land for agricultural use may be rated in four main categories, each of which may, as follows, be subdivided.

A - Suitable for Cultivation -

- Land Class I - Without any special practices.
- Land Class II - With moderate restrictions in use and the application of more specialized conservation measures.
- Land Class III - With more severe restrictions in use and the application of more specialized conservation practices.

B - Suitable only for Occasional Cultivation -

- Land Class IV - Best used for permanent vegetation but may be cultivated with intensive restrictions.

C - Suitable only for Permanent Vegetation -

- Land Class V - With no special practices or restrictions.
- Land Class VI - With some restrictions in use or special practices.
- Land Class VII - With severe restrictions in use or special practices.



OTTER CREEK WATERSHED BRANCH CREEK VALLEY

RECOMMENDED LAND USE
ACCORDING TO USE CAPABILITY

USE CAPABILITY CLASSES

SUITABLE FOR CULTIVATION

WITH NO SPECIAL PRACTICES

WITH SIMPLE PRACTICES

WITH INTENSIVE PRACTICES

SUITABLE FOR LIMITED CULTIVATION

WITH SOME SPECIAL PRACTICES

SUITABLE ONLY FOR PERMANENT VEGETATION

WITH SOME SPECIAL PRACTICES

WITH MODERATE RESTRICTIONS

WITH SEVERE RESTRICTIONS

RECOMMENDED MANAGEMENT

LAND REQUIRING EROSION CONTROL

BY CONTOUR TILLAGE METHODS

LAND REQUIRING ARTIFICIAL DRAINAGE

LAND REQUIRING RESTRICTIONS IN USE

(These apply only to classes II and III)

RESTRICTED USE

DUE TO ROUGH TOPOGRAPHY

RESTRICTED USE

DUE TO INADEQUATE DRAINAGE

(These apply only to class IV)

LAND UNDER EXISTING FOREST COVER

RECOMMENDED AUTHORITY FOREST

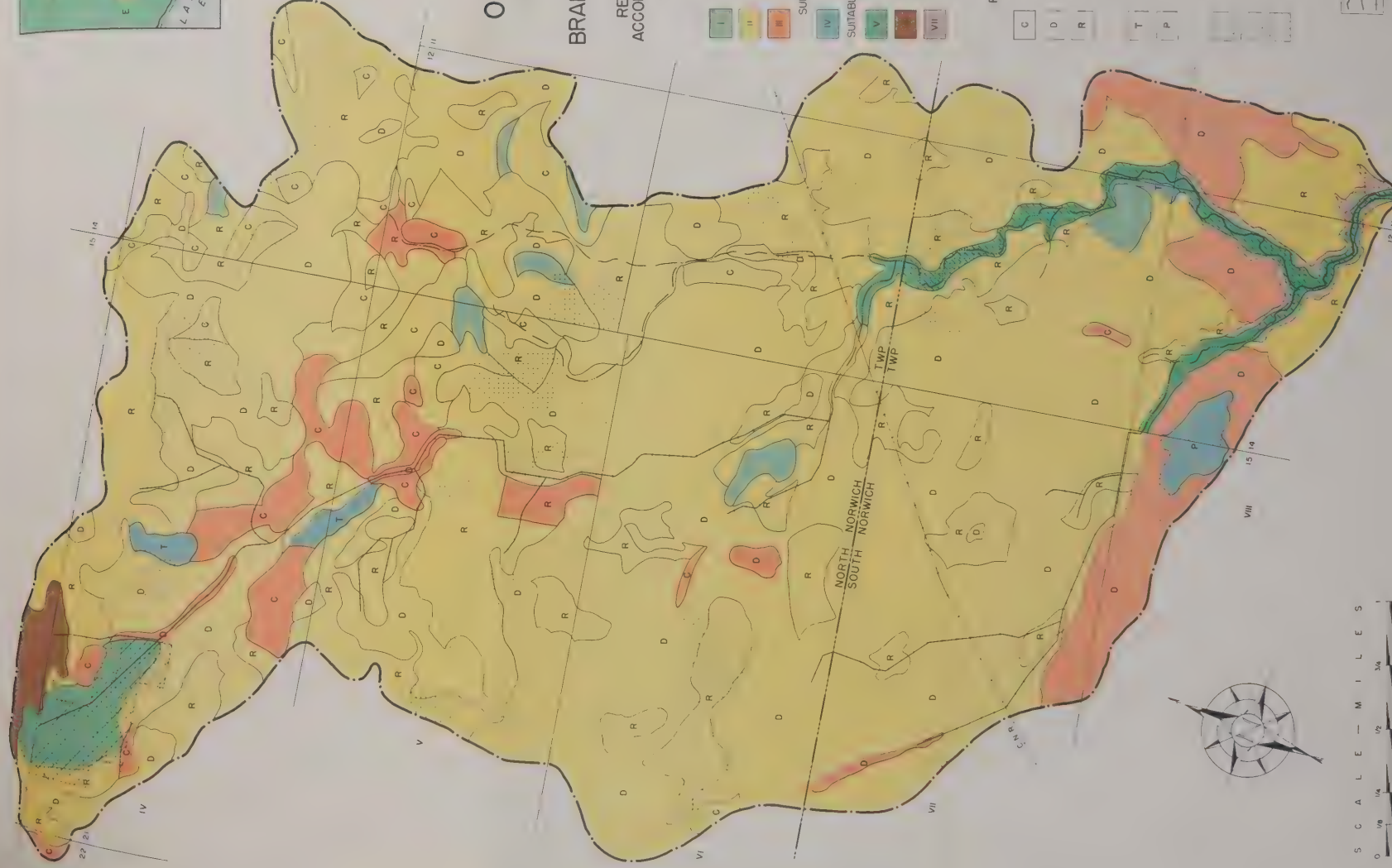
RECOMMENDATION FOR PRIVATE REFORESTATION

WATERCOURSES

PERMANENT STREAMS

INTERMITTENT STREAMS

DITCH DRAINS



D - Not suited to Cultivation, Grazing or Forestry -

Land Class VIII - Includes areas of rock outcrop, and marsh. There is none of this class on the watershed.

Using all the available information, and the above classification, each piece of land may be classed and so designated on a map. This has been done for the Branch Creek and a copy of the map accompanies this report.

2. The Land Capability Classes and Recommended Use

The above capability classes may be converted into classes of recommended use by indicating which special practices and restrictions are required for each type. The recommended classes are indicated by adding the symbols C, R or D to capability Classes II and III, and T and P to Class IV. Recommendations may be given as needed for Classes V, VI and VII. No special practices are required for Class I and normally no restrictions are placed on use. In some instances the land may be affected by more than one factor which would serve to influence the capability rating and also the recommended use. In such a case the more important factor is the determinant and the recommendation is made on the basis of it.

The symbol C is applied to land where the capability has been reduced through erosion which can be corrected by mechanical means such as contour tillage, diversion terraces, and strip-cropping. Land susceptible to erosion and capable of being farmed using these methods is also placed in this class.

Hummocky land and sloping land which is unsuited to contour tillage methods, although subject to erosion, drought, or fertility depletion, may be placed in Class R. Some types of level land may be also included. Vegetative methods of control such as rotations, winter cover crops, and soil building crops are indicated.

Wet land whose productivity can be improved by artificial drainage with minimum difficulty and expense is indicated by the letter D. Class III D requires more intensive drainage than Class II D.

Class IV land which is too rough or eroded to be put under regular rotation is indicated as IV T. Land which is too wet for regular rotations and on which artificial drainage is not feasible because of lack of outlet is classed as IV P. Normally suited as pasture land this class may, however, be cultivated and cropped in drier years.

3. Recommended Land Use Classes

Land Class I

The land designated as Class I comprises only a very small acreage, about 1.3 per cent of the total, and is confined to the level, well drained Huron soil. Erosion is negligible and the soil is reasonably fertile; it may be used freely without restriction. Certain practices should be adhered to, of course, and these include the suppression of weeds, fertilizing as needed and the maintenance of the organic content of the soil so that it will remain in good tilth and be moisture absorbent. Most of this class is now being cultivated but about 7 per cent is in forest cover. None is in pasture or other uses.

Land Class II C

Only a little over 4 per cent of the land has been placed in this class. It is smoothly sloping, with the slopes ranging from 2 to 6 per cent, and well suited to contour cultivation methods where the present or potential field pattern would permit. The class is confined chiefly to the Huron soil and erosion is slight to moderate. The conservation practices would include contour cultivation, strip-cropping and diversion terraces.

Grass waterways would find application in some places. Almost all of this class is now being cultivated.

Land Class II R

Rolling, hummocky land, and sloping land too broken for easy contour work comprise this class. It embraces over 28 per cent of the watershed. Drainage imperfections affect a fair amount of the land but drainage works would be rendered a little difficult in some instances because of the nature of the terrain.

This class is subject to sheet erosion on the knolls, to rill erosion, and to gully erosion in the ungrassed waterways. The conservation measures applicable include extended rotations, winter cover crops, and restrictions on row crops.

Some of the level sands at the lower end of the watershed are included in this class because of susceptibility to soil drought and to wind erosion, and because they are apt to lose their organic content and fertility rapidly under regular cultivation unless well managed. Strip-cropping is a benefiting measure in this area of tobacco growing.

Although the land of this class is well suited to cultivation about 30 per cent of the area is uncultivated or in forest. Most of the uncultivated section is in pasture.

Land Class II D

About 51 per cent of the watershed is in this class and most of it is cultivated to crop, to hay, or to hay-pasture. The imperfectly drained Perth clay loam is the common soil type but there is also some acreage of London loam. For the most part the land is level but some is gently sloping. Over most of the area erosion is slight to mild.

Restricted soil drainage is common on the watershed. Tiling helps produce better crops and makes the land easier to work.



Where poor drainage persists the crop may be killed or fail to develop. Under-tiling soon pays for itself.



Drainage ditches are common in the Perth and Brookston Soils but many are trampled by cattle and filled with weeds.

The chief need here is that of improved drainage, combined, of course, with measures such as those which apply to Class I land. A good deal of this land has been drained already but many of the tile under-drains are too small to do a good job or are not working properly. Often, too, fields have insufficient tile to do a good job. Most farmers realize that good drainage is a paying proposition and during the year of the survey (1955) a number were installing tile drains. A considerable amount of open ditch drainage and stream ditching has also been completed.

Land Class III C

This type, comprising 210 acres, or 3 per cent of the watershed, is found chiefly along the upper reaches of the stream. The slopes are steeper than for Class II C and the erosion generally has been greater. In addition to hay and grain these areas are carrying a considerable amount of intertilled crops, chiefly corn. It is likely this regime has been instrumental in causing the more severe erosion and it is recommended that so far as possible hoe crops be restricted from this land. As with Class II C use should be made of contour tillage methods, strip-cropping, terraces and grassed waterways.

Land Class III R

The land of this class is like that of Class II R but rougher or more eroded. Intensive restrictions in use are required to prevent further erosion and fertility depletion. Where possible hoe crops should be excluded. Nearly all of this class is cultivated but the acreage is small.

Land Class III D

Approximately 5.5 per cent of the watershed lands are contained in this class and most of the acreage

is found along the southern and south-eastern border. Mostly the soils are sandy, usually over clay at a few feet, but some areas of Brookston clay loam are included.

Artificial drainage is feasible on this land but would be more difficult and more expensive than on land of Class II D. Presumably the imperfect drainage has been instrumental in restricting the growth of tobacco from land which would otherwise be suitable for this crop. Over 10 per cent of the land is in forest cover and over 20 per cent is uncultivated.

Land Class IV T

Steep slopes and moderate to severe erosion are typical of this type. This land is best in permanent grass but may be broken and seeded to grain every few years. Fortunately a very small acreage of this type is found, less than 1 per cent of the whole.

Land Class IV P

This class is confined to the poorly drained sands and most of it is uncultivated or in forest cover. Except at undue expense this land is incapable of being drained and the benefit gained by so doing would not prove worthwhile. Its present use should be continued and the woodlot area fenced and improved.

Land Class V

Three per cent of the land has been thus classed and all of it is found either in the headwater swamp area or in the bottomlands along the lower reaches of the stream. In both cases the land is subject to annual flooding and drainage would prove impractical for ordinary agriculture.

The swamp is almost entirely covered by trees or brush and the muck deposit reaches a depth of up to 4 feet. During the summer of 1955 this area was dry, even to the bottom of the muck, and this may have been due partly to the dry summer and partly to the fact that the stream-course issuing from it has been ditched and tiled.

A good deal of the bottomland is in rough pasture and the balance in trees. The narrow flat-lands to either side of the stream are unsuited to cultivation and often provide the poorest of pasture. As shown on the map of recommended use this class includes the steep valley slopes where these are too narrow to differentiate. Some of this land would be better used if it could be fenced and reforested or, if already forested, improved and protected from grazing.

Land Class VI

A small area of steeply sloping, hummocky and eroded land at the headwaters has been typed as Class VI. Much of it is in pasture but some is being used for grain and hoe crops. For maximum protection and to reduce erosion it should be cultivated not at all or as infrequently as possible. Permanent grass with restricted grazing would be a satisfactory use for this land.

Land Class VII

Some of the valley slopes along the lower course of the stream have been rated as Class VII land. Only 44 acres are involved but the land is eroded and steeply sloping. It is not suitable for cultivation and none of it was being used for this purpose at the time of the survey. Land of this kind should either be maintained in permanent grass with severe restrictions on grazing to prevent over-grazing, or in forest which should be restricted from grazing and maintained.

From the foregoing it may be seen that nearly 80 per cent of the land of the watershed falls into two classes, II R and II D. In some cases the problems, and recommended solution, of one are nearly common to the other. The distinction between one and the other may in some instances, therefore, be a fine one.

It is believed, however, that the conditions and recommendations as mapped are true. In any appreciation of conditions of this kind, and the cartographic representation of them, there is always the problem of deciding where one category ends and should be replaced by another.

With respect to prevailing land use and the state of the land as compared to the capability and recommendations there is relatively little difference. By and large the land of the watershed is being used wisely and well. There are, however, individual problems of sheet erosion, gully and rill erosion, fertility depletion and weed control which have to be met. Some land is being used too intensively with respect to capability and some is not being used nearly as intensively as it might be,

The major conservation problem is that of restricted drainage and little of the watershed is unaffected by it to some degree or other. As mentioned previously most farmers are aware of the situation and many have done or are doing something to improve matters.

An important matter which should receive more attention is that of waterway improvement. There are many fields with small waterways which are being cultivated. These carry water only in spring or after a heavy rain but the erosion resulting along the water-course is often acute and along their lower ends fans of deposited material may often be seen. Courses such as these should be kept in permanent grass.

Along the main stream the narrow bottom-lands, together with the adjacent slopes, are used for pasture and woodland. As pasture this land often leaves much to be desired and it would be better reforested. Partly because of the limited acreage it would probably be undesirable for acquisition by the Authority for forest

land. Areas such as this could be reforested and managed privately with assistance from the Authority where possible. This also applies to the existing forested areas along these bottomlands.

TABLE 5

RECOMMENDED USE CLASS ACREAGES

Class	Acreage	Per Cent
I	92	1.3
II C	306	4.1
II R	2,110	28.7
II D	3,748	51.1
III C	210	3.0
III R	54	.7
III D	401	5.5
IV T	45	.6
IV P	42	.6
V	216	3.0
VI	57	.8
VII	44	.6
TOTALS	7,325	100.0

CHAPTER 5
CONSERVATION PRACTICES

1. Introduction

There are many soil and water conservation measures but they are all directed toward the elimination of bad land conditions and the improvement of the soil and its fertility and the production of better crops and animals. Not all of these measures are necessarily suited to any one section of the country; the requirements of range land may be different to those of a dairy area or of a truck crop producing area. Likewise, different fields on a farm may need to be dealt with differently because of differences in soil, in slope, in drainage, and in use. Where the recommendations of a report such as this will apply to a larger area, the watershed, the recommendations applied to a small segment of the watershed, a farm, will be more specific and come from a farm plan.

On the Branch Creek Watershed the practices outlined in this chapter may be used to advantage on most farms. Certain of them will not apply in some cases. Contour cultivation, for instance, will not be applicable on all farms simply because not all of them have land suitable for this type of tillage.

To ensure that the land is used as nearly as possible according to its capability a plan is a requisite. Its purpose is to indicate what each part of a farm is best capable of producing. From this the cropping and rotations of each piece of land are arranged and steps taken to maintain soil fertility, check soil erosion and gully development, rebuild topsoil where it has been lost by erosion, and protect waterways against gullyng. Water running off the land results in much trouble and an effort should be made to enable the soil to absorb as much of it as possible. Water controlled is a

friend and contributes to our high standard of living; out of control, even to a minor degree, it produces sheet erosion, excavates gullies where none were before, and goes off downstream for the use and benefit of none.

Conservation measures may be considered as being cultural or mechanical in nature. Cultural methods include such practices as extended rotations, improved pasture, and the use of green cover crops. The proper management of the woodlot may also come under this heading. Mechanical methods include drainage, farm ponds, contour ploughing and strip cropping, terraces and grassed waterways.

2. Crop Rotations and Cover Crops

A crop rotation means following a regular sequence of crops on a field with the same sequence repeated every several years. Cover crops are those crops which are planted mainly to protect or rebuild the soil.

The repetition of some cropping and tillage practices leads to rapid depletion of soil nutrients, the destruction of soil tilth and organic content, and exposes the soil to sheet, rill and gully erosion.

A good rotation installed with an eye on the land aids materially in combatting these results of malpractice. A rotation system, through the growth of different crops in sequence, draws plant nutrients from different levels, adds fibre by the ploughing under of crop residues, and improves tilth with alternative systems of tillage.

A large part of the value of crop rotations and cover crops depends on their ability to rebuild the soil, protect it from erosion, maintain organic matter, add nitrogen and keep the soil in good tilth, and increase the amount of water absorption. Better crops are a result. Crop rotations and cover crops are, therefore, among the more important tools of the conservationist.



Horseradish and millet are among the special crops grown on the level lands of the till plain. Much of the land is gently sloping but sheet wash can be serious, particularly on the low knolls. Evidence of this can be seen in the light patches in the fallow field to the left.



A pear orchard with a ground cover of buckwheat. Other orchard crops are also grown.

Crops may be classed as soil-building (the grasses and the legumes) and soil-depleting (grain, corn and root crops and other hoe crops). The latter group exhaust the soil most rapidly and expose it more readily to erosion and drought. The conservation farm planner arranges the cropping systems field by field, so that the land of lower capability, subject to erosion or already eroded has more of the soil-building and less of the soil-depleting crops. Land subject to serious erosion, or in that state, has the hoe crops excluded from it almost entirely. Under a suitable rotation the acreage of grain or hoe crops may be reduced but the yields maintained or even increased by making the land more productive.

Although the land of the watershed is being used fairly well there are a number of cases where too many of the soil-depleting crops are being grown in succession. Fields were noted where five or more of the soil-depleting crops had been grown one after the other. This is particularly true where cash cropping is important in the farm economy and less true where dairying is the main endeavor. Most of the soils are naturally fertile and fairly resistant to over-use, and the slopes are low enough that pronounced, widespread erosion has not occurred. Even the best of land must be treated with respect, however, if it is to remain productive and healthy over the long term.

On the tobacco lands at the south end of the watershed a two-year rotation of tobacco and rye is followed which has proved satisfactory for retaining the organic content, providing a cover crop and preventing wind erosion. This rotation is widely used throughout the tobacco belt of Norfolk and adjacent counties.

3. Drainage

Often the natural drainage of the soil is insufficient to provide a good environment for the growth of most farm crops. Under natural conditions the soil may produce

a crop, but one lacking in quality and yield because of excess amounts of water. Artificial drainage of land like this enables the soil to produce higher quality and more abundant crops and helps provide the farmer with a higher return for the same labour as before. A drainage system may often be paid for in the first year or two of its operation through greater return. Artificial drainage of its extensive imperfectly and poorly drained lands is a major conservation measure on the Branch Creek Watershed. Much of this land has already been drained but much needs yet to be drained, or the present drainage system improved.

Drainage has two main advantages. First of all it makes soils of high inherent fertility capable of carrying the full range of crops that are carried on the well drained soils of the region. In addition, of course, the farmer is able to get on his land earlier than he might otherwise be able to do. Strangely enough, poorly drained soils can become seriously subject to drought. In the early, wet part of the season crops cannot root deeply while in the hot, dry season moisture does not move readily upward in the characteristically massive, poorly drained soils and the shallow-rooted crops suffer from drought.

Drainage also helps to create storage capacity for moisture within the soil. A water-logged soil cannot store the excess precipitation of a heavy rain or the water of a spring thaw. Of course, the water may lie on the surface in pools or sheets and only slowly seep away. This point is of perhaps lesser importance on the imperfectly drained soils, as compared to the poorly drained ones, but it is of some account.

Open drains are effective for the removal of surface water and they also serve as outlets for tile drains. Their value for soil drainage is restricted except, perhaps, in the immediate vicinity of the ditch. Any problems connected with drainage of this type are largely those of ditch

maintenance. A ditch built with gentle slopes and well spread spoil banks may be a little more expensive to build, but the cost of maintenance is much lower and it remains effective for a longer time. Gentle banks with slopes as low as one in three do not slump in or erode as badly or as readily as steeper banks. Vegetation which may plug a ditch is more easily controlled by cutting with a mower.

To be effective a tile drainage system should be properly installed, the tile should be adequate in size, and there should be a sufficient number of lines. In addition, the outlet should be well protected. This important part of the drainage system is one too frequently overlooked and as a consequence often causes considerable trouble. To provide good outlets, the last few feet of drain should be of vitrified tile or corrugated metal pipe extended several feet out into the ditch or stream. It should be provided with a head wall to prevent cutting back and an apron to prevent scouring. Neglect of these important details can and has led to the development of serious gullying in Ontario and elsewhere. Finally, a screen or gate over the tile outlet will prevent the entry of animals and risk of plugging the tile.

4. Improved Pasture

There are many good pastures on the Branch Creek Watershed but at the same time there are some which can be developed to greater productivity. The fact that this region is near the heart of one of the two striking concentrations of dairy cows in Ontario no doubt explains the generally excellent development of pasture land.*

A long-term improved pasture is one that is seeded to grasses and legumes and left for five years or more. It may be renewed by reseedling with or without the use of a

* The other concentration is centred in Dundas County in Eastern Ontario.

nurse crop such as oats. Production of field crops is eliminated or kept to a minimum and as a result the soil is kept under a protective cover of soil-building grasses and legumes at all times.

A major portion of the farm income of Ontario and of the Branch Creek watershed comes from the sale of animals or animal products. This, in turn, depends on the grass of the field and because of this pasture should never be considered as merely a lesser use of land but should be considered as a crop which gives good return for the capital and labour put into it. The carrying capacity of pasture in animals per acre or in yields, in tons of forage, pounds of meat, or gallons of milk, usually can be increased considerably over what is commonly accepted as average pasture.

There is no need to dwell on this aspect of pasture in a report on conservation, but the importance of pasture to control erosion and improve the soil moisture relations is overlooked and needs to be stressed here. Grasses and legumes provide organic material for the soil and protect it almost completely against erosion. By improving the soil structure and providing a continuous cover the impact of the rain is dispersed and the water is more readily able to enter the ground to the benefit of the crop and of the groundwater supplies.

Specific recommendations for the preparation and seeding of pastures may be obtained from bulletins distributed by the Department of Agriculture and through the County Agricultural Representative.* Soil tests and the

* Useful bulletins include:

- (a) Guide to Crop Production in Ontario. Ontario Department of Agriculture, Extension Bul. No. 68.
- (b) Soil Management and Fertilizer Use. Ontario Department of Agriculture, Bul. No. 497.
- (c) Better Ontario Pastures. Ontario Department of Agriculture, Bul. No. 469.
- (d) Fertilizers for Cereal, Hay and Pasture Crops. Ontario Dept. of Agriculture. Circular 144 (Rev. May 1955).
- (e) Better Pastures in Eastern Canada, Dept. Agri. Ottawa, Pub. 809. Farmers Bul. 150, Oct. 1948.

application of fertilizer are just as important in the production of top-quality pasture as in the production of other crops.

Management of pasture after seeding and in the years before it is renovated is important so that production may be maintained and the expense of working, seeding and fertilizing more than repaid.

Occasional clipping of pasture helps to maintain a thick turf and so protect the soil, and is a decided aid in controlling weeds. Raking of pasture to spread out the animal droppings makes the pasture more agreeable to the animals and makes the best use of their droppings for fertilizer.

5. Contour Cultivation and Strip-Cropping

Contour tillage entails the adoption of methods whereby the land is cultivated "on the level" along the contour and at right angles to the slope. The best slopes for this treatment are broad, smooth and not too steep. Satisfactory work may require the removal and/or relocation of one or more fencelines. Most farm fields in Ontario were fenced according to the rectangular survey grid and not according to the "lay of the land". When considered from the point of view of how to work the land best the need for fenceline adjustment is obvious.

When the land is tilled on the contour each furrow or drill row acts as a small dam to retain the run-off water which is better able to be absorbed by the soil. This is particularly true during the period when the crops are making much of their growth and need the water most. As time goes on the small cultivation ridges become levelled by rain and wind and become less effective. By that time the crop itself has grown sufficiently to offer protection to the soil.

Besides the benefits obtained through the reduction of water and soils loss, contour tillage offers

greater ease and economy of operation of powered implements. If the strips are fairly long, turning has to be done less frequently, and of course gear-changing and changing power loads are reduced. One study showed time savings of nearly 13 per cent and fuel savings of nearly 10 per cent when contour cultivating with powered implements.

Strip-cropping is often carried on in conjunction with contour tillage. This means the establishment of hay or pasture strips on the contour, and alternating with strips devoted to grains or intertilled crops. By the use of such a method any water which escaped from the cultivated strip, and which carried soil with it, would be slowed down by the grass and the sediment dropped. This strip-cropping has in mind mainly the reduction of water erosion. In the tobacco area to the south strip cropping is common on the level and gently-rolling sands. The main purpose in this case is the protection of the land from wind erosion.

6. Terraces

Terraces are broad, shallow ditches running across a slope with side grades gentle enough to allow implements to work over them. They may be cultivated or left in grass. Their purpose is to break a long or steep slope so that overland flow of water down the slope is checked, forced to penetrate the ground, and the surplus is diverted at lower speed across the slope. They have a slight downhill gradient, just enough to carry the water away. They empty surface water into a watercourse or structure in which it can be carried safely away.

Terraces prevent serious erosion on lower slopes where water otherwise attains great velocity and erosive power. They get more water into the ground. Terraces deliver heavy flows of water harmlessly to natural waterways.

Terraces may be combined with contour strips and tillage or may stand on their own. Once a long slope has been



Grassed waterways are often needed on gently sloping land but they should be wide enough to do the job and be able to provide pasture or hay. If the proportions are not ample sheet or gully erosion may still take place.



Good land will continue to produce good crops if well managed.

divided into two short ones by means of a terrace, there may be no need to carry out other intensive practices of contouring.

Some broad-based terraces for diverting run-off have been built in Ontario using special equipment such as a road scraper or an implement called a Whirlwind Terracer. A few demonstrations of terraces might be arranged by the Authority, using these methods. Actually, they can be constructed with a farmer's own equipment, such as tractors and ploughs or disc tillers. Once a few farmers in a district have learned the technique of making them, and any good ploughman can do so, all that is necessary is a little technical assistance in laying them out with a level and some consideration of the amount of water they may be expected to carry.

Once established, terraces must be checked for faults or failures and must be properly maintained. Pronounced low spots should be filled and the flow of water kept uniform. Cultivation is on the contour. Any sediment that collects in the trough is turned upwards to the rim by ploughing.

Before terraces are constructed, a safe outlet must be provided. In many cases this will be a permanently grassed waterway. Meadowland or woodlots which resist erosion can be useful discharge places for surplus water.

7. Grassed Waterways and Diversion Channels

Many fields on the watershed have small channels crossing them which collect water from their own small watersheds in spring and after heavy rains and the rest of the time are dry. Nearly always these channels are cultivated with the rest of the field and no attempt is made to protect them. This results in a gradual enlargement of the channel through erosive downcutting, erosion of adjacent slopes, a heavier silt load for the main stream and, if the watercourse debouches on to flatter land, a fan of silt and gravel which increases in size and covers the crop. This can happen on very gently sloping as well as on steeper land. A good, though small, example of

this was seen by the members of the Authority during their tour of the watershed in the fall of 1955.

These waterways should be planted to grass, should be wide enough to handle expected flow, and should be maintained. The banks of the waterway should be gently sloping and the grasses used should be those which will provide a thick, interlocking sod. Under management a waterway can provide substantial amounts of hay and pasture and aid in the delivery of clean water to the streams; the thick sod reduces the speed of the overflow and leads to the deposition of the silt load in the waterway.

The simplest grassed waterway is established by tripping implements as they cross the sod on a watercourse when the hay or pasture in a field is being disced or ploughed under. This type would find wide application on the watershed. By filling and grading it is also possible to convert gullies into grassed waterways. Such a measure is, of course, more difficult and more expensive to do and may require the diversion of water from the head of the gully, at least until control has been established. Fortunately gullies of consequence are not common in the area.

The importance of sod waterways, in conjunction with contour tillage, in the reduction of watershed run-off has been shown by studies in Ohio. These studies showed that a reduction of 75 - 80 per cent was gained at the start of the season. This dropped to as low as 20 per cent later but produced an annual average reduction of 66 per cent. A reduction of even 20 per cent is valuable and one of 66 per cent even more so. The significance of this on the production of better crops and higher yields will not be lost on most farmers.

8. Farm Ponds

In recent years there has been a considerable development of interest in farm ponds in Southern Ontario and a large number have been built. At the forefront in support of

this development have been the various Conservation Authorities.

An adequate water supply is essential on any farm although the amount needed and the use or uses to which it will be put will of course vary. In most areas the use of water is increasing and there is a continuing search for new or better supplies.

On most farms water is needed for domestic use and for stockwatering and the supply often fails or is much reduced in a dry year. With the increasing use of water for irrigation of special crops such as tobacco and fruits and the possibility of irrigating such crops as pasture a good water supply becomes an imperative need. Most often supplies of this order are unobtainable from ordinary wells and recourse must be made to ponds.

Farm ponds are excellent as a source of water for most uses and they may be designed quite readily to fit the needs of the farm. Too, the pond may be good for more than a single use as, for example, for orchard spraying, stockwatering, irrigation, recreation, fire protection and fish. When designing the pond the probable uses should be kept in mind.

There are several kinds of ponds - dug-out, spring-fed, run-off, by-pass, and permanent stream and it is probable that at least one of each type could be built on the watershed. A large portion of the stream and nearly all of its tributaries are dry during summer, however, and the most practical and important types will thus be the run-off and dug-out ponds.

The dug-out pond is built in a depressional area and receives its water supply from the ground water down to which it is dug. Often these wet low spots are of little value for much else and the pond may be built quite cheaply. Most of the irrigation ponds of the tobacco belt are of this

type and there are many places on the Branch Creek Watershed where they may be built.

A run-off pond depends, in summer, entirely on the amount of rainfall which occurs at that time. It is obtained by building a dam across an intermittent watercourse draining a small area. If the slopes are mostly woodland or permanent pasture or a combination of both the supply will be more even. If the slopes are cultivated fields there will be danger from too rapid run-off and silting unless these are cultivated on the contour or strip-cropped. The dam should be well constructed and of sufficient size. When building any dam professional advice respecting the engineering aspects is desirable. Engineering assistance in layout and building of a pond may be obtained from the Otter Creek Conservation Authority.

CHAPTER 6

FARM PLANNING

To most farmers the idea of planning is not something new; in some measure or other they plan the use and management of their land so that they know a year or so in advance what cultivation sequence they are going to follow. They plan for repairs to buildings, equipment, fences and so on. They plan so far as they can the day to day and month to month work they are going to do, and much of it becomes routine. Planning, in short, is an essential feature in the life of the farmer as it is with anyone concerned about his future.

Although many farmers have a plan regarding the use to which they put certain or all of their fields, relatively few have had their farms planned so that the maximum use, consistent with the best use, is made of each piece of land. The object of a plan of this sort is to enable the farmer to get the most out of his land and at the same time to do it in such a manner that no damage to the land occurs. When a farm is planned each piece of land is judged according to its capability to produce, and various use recommendations are made. These may include pasture management, crop rotations to follow, woodlot management and reforestation, farm drainage, fenceline removal or relocation, or any other works and practices which would benefit the farmer and his land.

Planning does NOT need to be so rigid that there is only ONE recommended use or management for a piece of land of one class. Alternative recommendations may be made for a piece of land in a certain class. The first rule is to apply the easiest and cheapest remedy. The next thing that determines the choice of use is the relation of the field to the rest of the farm. Other factors apply, such as suitability for using powered mechanized equipment, or the distance

from the barn and ease of access. The final determination depends on the crops and animals the farmer chooses to carry. The final plan, therefore, is the end result of a good many compromises and at each stage of preparing the plan certain choices have to be made.

In this section an actual farm plan, prepared by the Soil Advisory Service of the Soils Department of the Ontario Agricultural College is presented. The soils are typical of those found over much of the watershed.

In developing the plan a farm planner goes over the farm field by field and maps the soils as he finds them. He uses an aerial photograph as a base map. The soil series and types are identified and an estimation of the degree of erosion is made by examining vertical sections of the soil. The slope of the land is measured, using a hand level which gives slope as a percentage. A rise of four feet in a run of one hundred feet, for example, is a 4 per cent slope.

The occurrence of watercourses, either permanent or intermittent, with or without a definite channel, is noted, as are fencelines, stonepiles, springs, seepage areas, gullies or any other items of importance.

All of the information gathered is marked on the map, using symbols, and each piece of land of the same type with respect to soil, slope and erosion is delimited by a boundary line.

From the map of soil type and conditions a map of use capability is prepared. Each piece of land is assigned to one of eight capability classes. These classes are the same as those used for the watershed and are included here as part of the plan. On any one farm not all classes will necessarily be found.

The plan of the farm is then worked out with the farmer so that each field, or each piece of land, is put as nearly as is practicable to the use which fits the capability.

Any systems of tillage or cropping or special practices to control erosion and water loss are applied where necessary. The fields and rotations are worked out so that there is the correct balance of pasture, fodder and grain to meet the requirements of the herd which the land can carry.

Before the planned rotations are put into effect it may be necessary to arrange a transition period in which the change-over from present cropping to the planned rotation is made without losing a year of cropping. Also, it may take a year or two to get special devices like grassed waterways and terraces in working shape. A time of transition such as this may also prove useful in providing a period during which any desired changes in the plan may be implemented.

In adjusting use to capability it may not be possible to outline fields exactly according to natural soil conditions. The inclusion of a small area of, for example, Class II land in a field which is predominantly Class I land may mean that this small area of land of lower capability will be worked as intensively as the Class I land. This is not strictly following the principle of "using each acre according to its ability", but is a compromise weighed against the possible cost of fence removal, difficulties of tillage and so on. In a plan, therefore, there may be found one or more small areas of one land class within a larger area of another land class.

FARM PLAN

for

ELDON HERNER

Currie, Ontario

County - - Oxford
Township - - East Oxford
Concession - V
Lot - - - 18
Part of Lot - South half

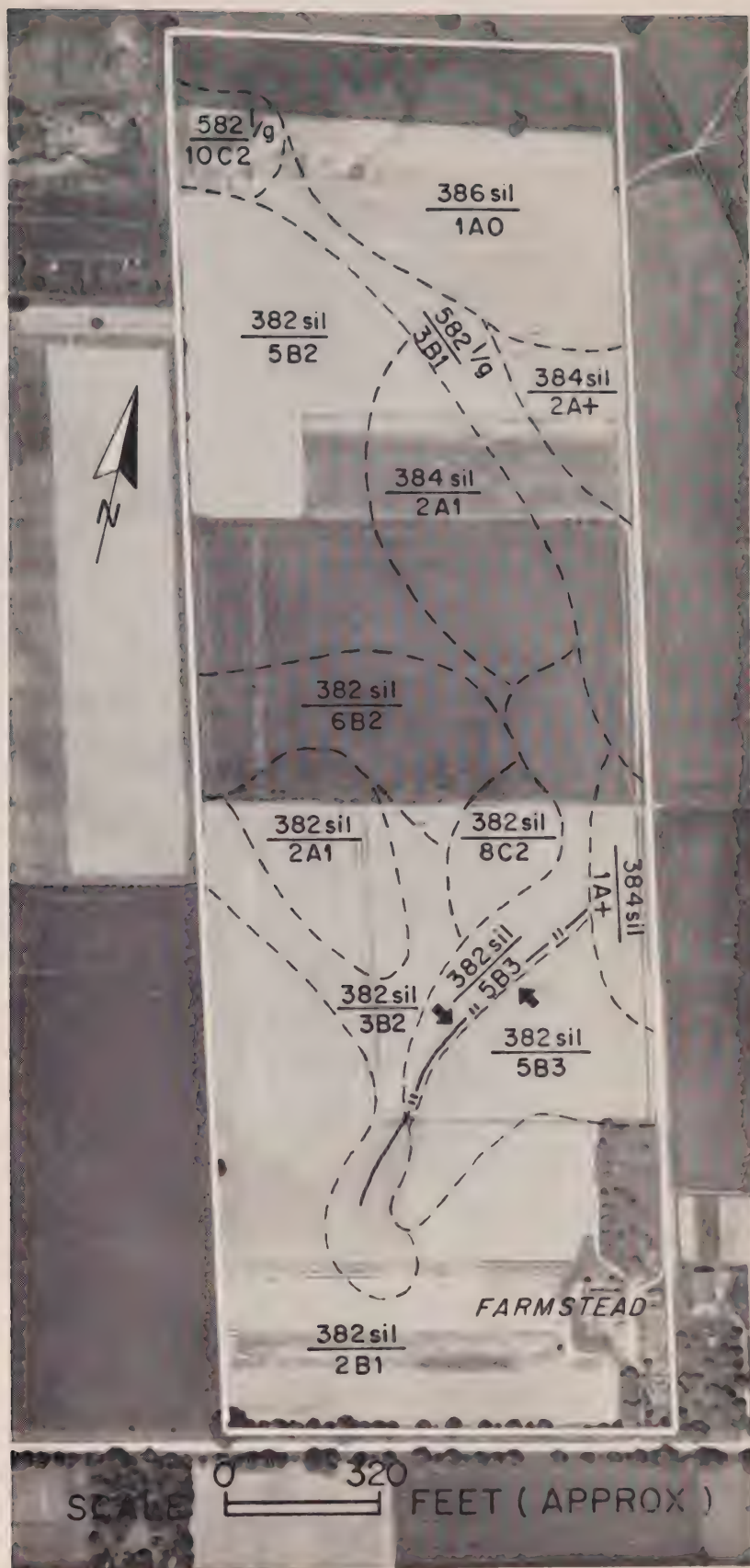
Planned by

G. Baker

The Soils Department, Ontario Agricultural College

In co-operation with Mr. Herner

SOIL, SLOPE AND EROSION



MAPPING SYMBOLS USED IN FARM PLANNING

MAPPING SYMBOL (EXAMPLE)

382 sil ← Soil Type
 6B2 ← Degree of Erosion
 ← Slope Group
 ← Per cent Slope

Stoniness not a factor of importance on this farm.

SOIL TYPES ON YOUR FARM

382 sil - Huron silt loam
 384 sil - Perth silt loam
 386 sil - Brookston silt loam
 582 1/2g - Burford loam

SLOPE GROUPS

UNIFORM SLOPES

A-0-2 per cent	E-15-20 per cent
B-2-6 " "	F-20-30 " "
C-6-10 " "	G-30+ " "
D-10-15 " "	

IRREGULAR (HUMMOCKY) SLOPES

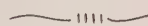


M-0-7 per cent
 N-7-15 " "
 P-15-25 " "
 R-25+ " "

DEGREE OF EROSION

WIND AND WATER EROSION

- 0 - No noticeable erosion
- 1 - Up to 1/2 of the "A" horizon removed by erosion.
- 2 - Same "B" horizon material in the cultivated layer.
- 3 - Some "C" horizon material in the cultivated layer.
- 4 - Gullies too deep and too frequent for the land to be cultivated.
- + - Accumulation of eroded materials.






INDIVIDUAL GULLIES

Shallow 
 Into subsoil 
 Into parent material 

STONINESS

- 0 - No stone
- 1 - A few stones but not sufficient to interfere with cultivation.
- 2 - Sufficient stone to be a nuisance to cultivation but land can be used for regular rotation
- 3 - Too much stone for cultivation but land suitable for pasture.
- 4 - Too much stone to be used for pasture but suitable for trees.

WATERCOURSES

Permanent streams 
 Intermittent streams 
 Spring 
 Sod waterway 
 Proposed tile 

OBJECTIVES FOR FARM PLAN

The following plan for the use of the land on your farm is designed to:

- (a) be a practical working unit.
- (b) Use the land according to its capability without serious deterioration.
- (c) Maintain the soil at an economically high level of productivity.
- (d) Produce an approximately equal acreage of each crop each year.
- (e) Minimize soil and water losses.

In preparing the plan the following procedure is followed. First, the soil, slope and erosion are mapped on an aerial photograph. Second, the capability for agricultural use is then worked out on the basis of type of soil, stoniness, drainage, steepness of slope and the tendency of the soil to erode. Third, in co-operation with the farmer the farm layout and crop rotations are worked out on the basis of the land-use-capability units (described in the following pages).

Suggested cultural, management and fertility practices are outlined. The location and acreage of any crop in any year is readily found by referring to the cropping schedule.

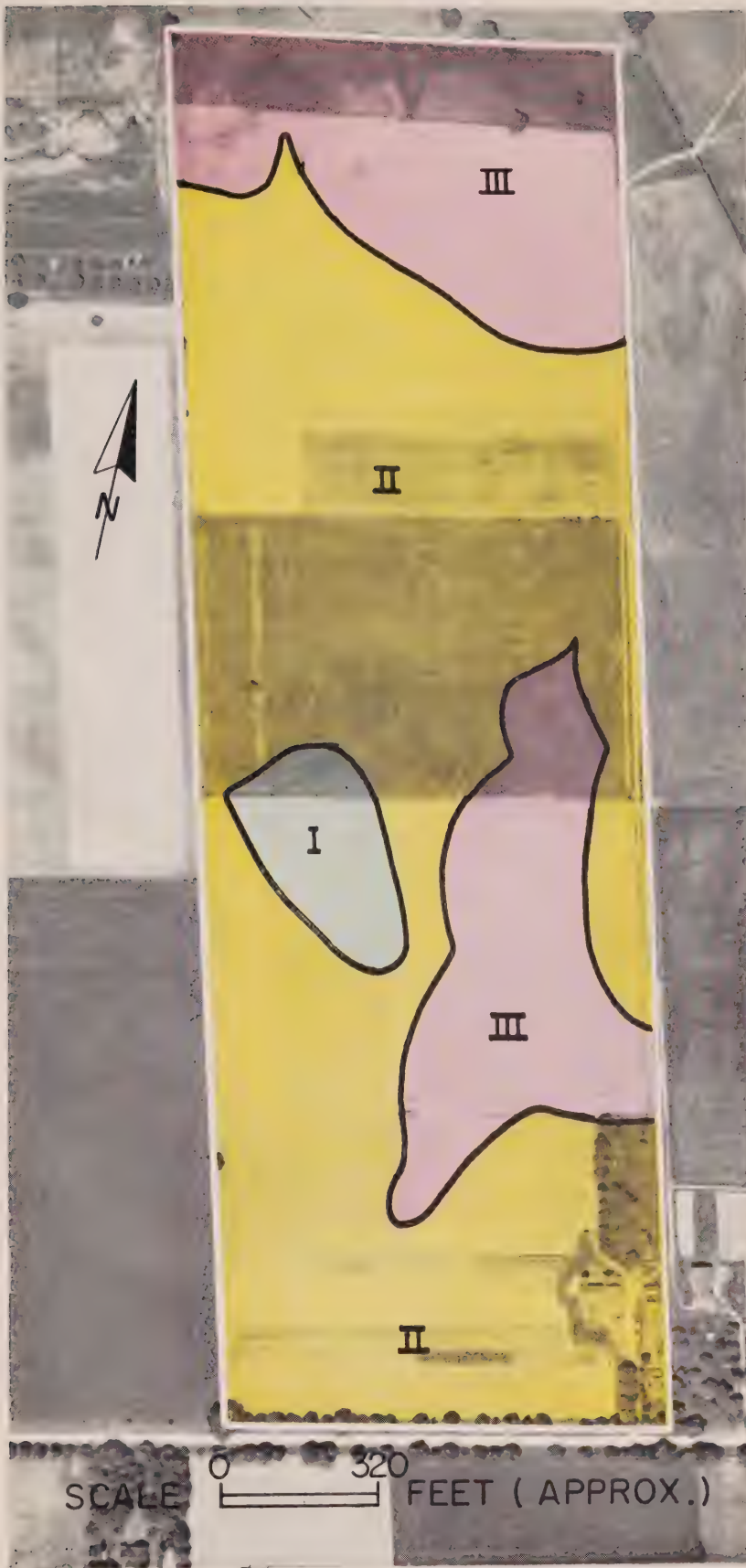
Discussions on cropland, permanent pastures and woodlots should be supplemented by material found in various bulletins dealing with the different subjects. The material found in such publications is based on years of experience and experimental work and should be adapted to your farm in so far as is practical and applicable.




LANDS WHICH MAY BE CULTIVATED

Class I (Green)

Class I land is suitable for cultivation without special conservation measures. It must be nearly level, workable, productive, well-drained and not subject to erosion or overflow. This land requires the addition of plant foods

LAND USE CAPABILITY



I	
II	
III	
IV	<div>None</div>
V	<div>None</div>
VI	<div>None</div>
VII	<div>None</div>
VIII	<div>None</div>

that are used by crops or lost by leaching. These plant foods are returned by barnyard manure, green manure crops or commercial fertilizers. Crop rotations to assist in maintaining the productivity are recommended.

Class II (Yellow)

Class II land is suitable for permanent cultivation with some simple practices often required. Chief types of practices are erosion control, water conservation, correction of moderately low fertility and the removal of boulders. The practices to conserve soil and water include contour cultivation and strip cropping with crop rotations that include legumes and grasses. The various sets or combination of practices must always be practical and useful in maintaining soil productivity.

Class III (Red)

Class III land is suitable for permanent cultivation with intensive conservation measures. This land requires careful and intensive application of practices to conserve soil and water. The type of practices are similar to those applied on Class II land but their use must be more intensive and widespread. Class III land requires longer rotations of legumes and grasses, cropping in narrower strips, buffer strips, grassed waterways, diversion ditches and greater use of cover crops. Class III land is generally characterized by one or more of the following features: steeper slopes, greater degree of erosion, lower fertility or handicapped by stones, boulders and poor drainage. This land requires additional treatments to maintain the soil at adequate fertility levels for the production of moderate to high yields of good quality crops.

Class IV (Blue)*

Class IV land is suitable for occasional or

* These classes are not found on the farm described here.

limited cultivation. This land is generally handicapped by one or more of the following: steeper, more severely eroded, more susceptible to erosion, more difficult to drain, less fertile, droughty or restricted in use by stones, boulders, or scrub tree growth. The types of conservation measures applied to this class aim at removing, in so far as possible, the limiting features. To reduce soil losses and conserve rainfall on the steeper slopes, five- to six-year rotations consisting of one year grain and the rest in clovers and grasses are frequently used. Class IV land may be set aside as a pastured area to be broken up and reseeded every fifth or sixth year.

LANDS WHICH SHOULD BE KEPT IN GRASS OR TREES

Class V (Dark Green)*

Class V land is not suitable for cultivation but is suitable for a permanent vegetation that may be used for grazing or woodland. This land is not subject to erosion but is generally too wet or stony for cultivation.

Class VI (Orange)*

Class VI land is suitable for permanent vegetation that may be used for restricted grazing or woodlot. Most of the land is moderately eroded or steep droughty soils of low fertility. When used for grazing such restrictions as carrying capacity, deferred grazing and rotation of grazing must be practised.

Class VII (Brown)*

Class VII land is not suitable for cultivation and requires severe restrictions if used for grazing. Pastures generally require liberal applications of fertilizers and careful regulation of the grazing. A large part of this land should be reforested or kept in woodlot and fenced from livestock. Most of the land in Class VII is steep, rough,

* These classes are not found on the farm described here.

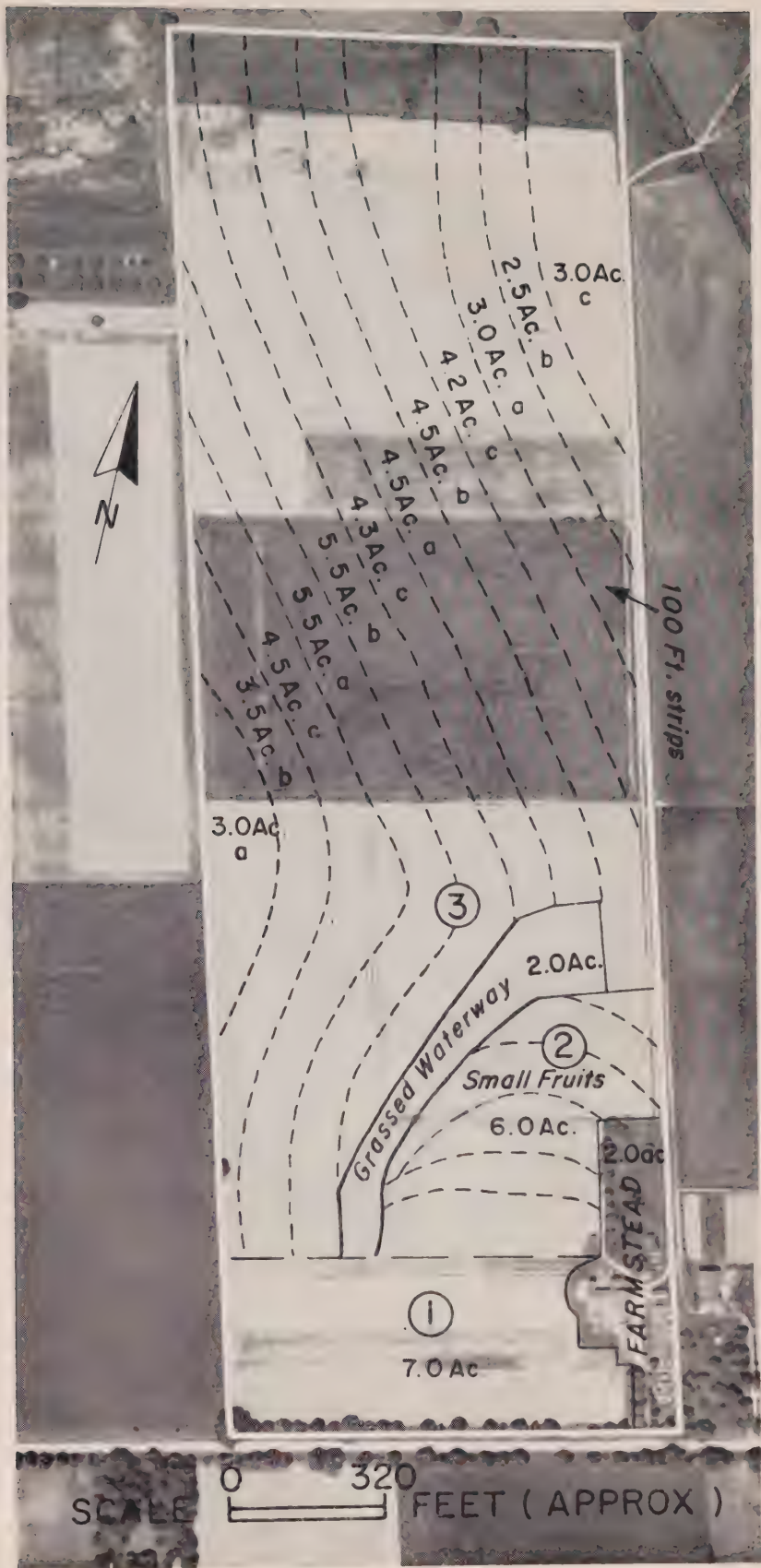
eroded and highly susceptible to erosion.

Class VIII (Purple)*

Class VIII land is not suitable for cultivation or the production of permanent vegetation. The land is chiefly rough, extremely stony barren land or swamps and marshes that are permanently wet and cannot be drained.

* These classes are not found on the farm described here.

FARM PLAN



CROPPING PLAN

<u>Field No.</u>	<u>Acreage</u>	<u>YEAR</u>		
		<u>1</u>	<u>2</u>	
1	7.0	Flowers, small fruits, etc.		
2	6.0	Flowers, small fruits, etc.		
3(a)	16.0	RC	HC	SG
(b)	16.0	HC	SG	RC
(c)	16.0	SG	RC	HC
Red clover (RC)		16.0	16.0	16.0
Hoe crop (HC)		16.0	16.0	16.0
Spring grain (SG)		16.0	16.0	16.0
Flowers, small fruits, etc.		13.0	13.0	13.0
Cropland		61.0	61.0	61.0
Grassed waterway		2.0		
Homestead, lanes, etc.		2.0		
Total acreage		65.0 acres		

The farm is operated basically as a market garden enterprise, with a limited number of livestock. The farming practices suggested are based on the soil conditions existing on the farm and the enterprises followed.

Cropland

This plan is a practical and effective means of conserving soil fertility as well as controlling soil erosion. It presents suggestions for soil management and crop rotations that meet the objectives of good land use.

The preceding map of the farm gives the field layout, number of fields, acreage and plan of operations. This will serve as a key to cropping rotations and practices.

Rotations and Practices

Fields 1 and 2 are not in a definite rotation and can be used for flowers, small fruits, hoe crops, etc., at your own discretion. These areas are less subject to erosion but require basic fertility applications and organic matter maintenance.

Field 3 is divided into strips (a), (b) and (c). A three-year rotation of hoe crop, spring grain seeded to red clover is suggested. This rotation of crops on the strips will reduce soil and water losses due to run-off.

More cash crop may be substituted in place of the grain crop if mulches, winter cover crops and green manuring crops are used. These will aid in controlling erosion and maintaining a high level of production. Where cash cropping occupies a high percentage of the workable land area, it becomes more necessary to apply the added measures listed above.

Fertility Maintenance

The use of complete fertilizers as well as ploughing down the one-year-old sod will help maintain satisfactory fertility and organic matter levels. A fertile soil

with sufficient organic matter is much less likely to erode than a soil low in fertility and low in organic matter.

In order to maintain a good fertility balance, soil samples should be taken and sent to the Department of Soils, Ontario Agricultural College, for analysis and fertilizer recommendations.

Grassed Waterways

Excess water must leave the farm, and in order to facilitate this removal with the least possible damage, a grassed waterway is recommended.

The seeding mixture should contain mainly grasses, as a dense sod is required. Clipping of the waterway should be done at least twice a year.

Contour Strip-Cropping

Contour strip-cropping is a practice recommended for the farm to control soil erosion under intensive cropping. Because of the general uniform direction and amount of slope, the contour strips are of even width. These strips are level and follow the topography of the land, hence each plow furrow acts as a small dam.

There should be no difficulty in cultivating and maintaining these strips.

THE PLANNED FARM



COMMENTS ON THE FARM PLAN

Although the farm described here is not within the watershed and is not primarily a dairy farm there are, nevertheless, various aspects of the plan which are of considerable interest with reference to the watershed. The soils are of the same types as those to be found on Branch Creek and the topography is quite similar. Also, quite a number of farms on the Branch Creek are engaged to some extent in cash cropping.

Neither the watershed nor the farm are plagued by excessive soil erosion, but in both cases there is room for improvement. The measures recommended for this farm will help in no small way to build up the soil organic content and improve the soil structure. They will also be of direct benefit in improving the soil-moisture regime by retaining more of the precipitation on the land.

Under certain conditions it is never possible to retain all of the precipitation; some is bound to flow away as surface run-off. Where this water flows in a channel there is a great risk of gully erosion if the channel is cultivated. This happened on the farm described here and is a common occurrence on the Branch Creek, although in only a few cases has the situation as yet become serious. Channels such as these should be kept in permanent vegetation after any necessary channel grading is completed. Grassed waterways are often well supplied with water and with fertile silt which becomes trapped in the grass as the speed of water flow is reduced. If made sufficiently large they can be an excellent source of hay.

Little more needs to be said about this plan except that the measures indicated could be applied on almost any farm in the watershed. On some farms, of course, there would be a reduced emphasis on contour work and a greater emphasis on permanent grass and on rotations. Nevertheless, this is a good example of a farm plan.

CHAPTER 7

CARRYING OUT THE LITTLE VALLEY PROGRAM

Accompanying this report is a map which shows all the land on the watershed divided into the various recommended land use classes. It can be considered as a guide to the future use of the land, but not an unchangeable plan of how the land must be used.

The more closely use and management of the land fit the pattern of the map, the more nearly the aims of soil and water conservation will be achieved. Adjustments of land use, or the introduction of special methods of tillage and cropping, need not reduce the overall acreage of field crops although this may happen in individual cases. Where changes are indicated in the management of cropland, soil productivity and soil and water conditions generally will be improved.

Some areas of higher capability land are shown which are now in forest cover. It is not necessary at the present time to remove these stands in order to provide more cropland but as the trees mature the land might be cleared and devoted to crop. Likewise, there is land unsuited to the production of good crops or pasture which would be better reforested. By gradually changing the present pattern of land use to the one recommended a better adjustment of use to land will be achieved.

On most farms there are areas where changes in use should be made but which have not been included in the map because of their small size. These areas would be dealt with in a farm plan, as would any changes needed on the individual farm. For this reason, and the fact that much of the work will be done by the individual farmer, it is suggested the Authority urge each farmer to have his farm planned by the planners at the Agricultural College. The Authority might find it convenient to employ a competent man for a month or so for this purpose.

Two major areas on the watershed are recommended to reforestation and woodland management. The wooded peatland at the head of the stream is recommended for acquisition as Authority Forest. The other area is considered unsuitable for this purpose for a number of reasons and it is recommended the land be reforested privately or managed if woodland already exists. Where possible the Authority should aid in this project.

Generally speaking the lands of the watershed have been managed quite well and erosion is not as severe as is often found elsewhere. There are, however, many areas where fruitful work can be done. Gullies are to be found along the main stream and elsewhere and these should be rehabilitated, perhaps with Authority assistance where this proves necessary.

There are, also, many areas where grassed waterways would be beneficial. In most instances they can be built by the farmer himself, often by simply leaving the waterway in grass. In more difficult situations the Authority might be able to provide technical assistance or machinery. The same more or less applies to contour tillage.

Whatever the program publicity and co-operation with interested agencies are essential to its success. The Authority should endeavour to see that each farmer is fully informed regarding the development of his watershed. Real progress will be made only if each farmer knows what is going on and contributes his support. Given time and effort there is no reason why this Little Valley could not become a model for others to follow and a source of pride to all who live in it. Such improvement would also be beneficial to the farmers in a material way in helping to maintain better land and stream conditions.

FORESTRY

CHAPTER 1

THE FOREST IN THE PAST

1. At the Time of Settlement

Good early descriptions of the forests of Southern Ontario are rare, for the early settler regarded the forest more as an obstacle to cultivation than as a positive asset worthy of recording. However, a fairly good picture may be obtained by piecing together the scattered information which does exist. Such early concern as there was with timber resources centred around pine and oak for the British navy and the easily cut softwoods for building purposes. Fuelwood was important, but was everywhere abundant and not worthy of special note. In addition the type of timber was of indirect interest as an indication of the quality of the land; pine - oak forests indicating light, easily worked soil, and maple - beech stands suggesting richer but heavier soils.

In order to record this information prior to settlement, the early surveyors were instructed as follows:

"Your field book is to be kept in the accompanying form, comprising the kind and quality of the soil and timber, entering each kind of timber in the order of its relative abundance."

In accordance with these instructions, the surveyors' notebooks included a running account of the composition of the forest cover along every line they ran, and thus they provide a reasonably accurate picture of the original bush in each township surveyed. Only for pine is the record at all detailed as to size and quality.

Surveys on the northern parts of the Otter Creek Watershed were started in 1797, and all townships in the watershed were surveyed by 1832. From the surveyors' field notes it is clear that they worked through a forest almost untouched by man but broken here and there by a "marsh",

a "cranberry bog", a "willow meadow" or a patch of "windfall". Windfalls were frequent, and one surveyor notes in such a patch of down timber "this a Hurricane". In Houghton Township, particularly, the windfall areas developed into "thicketts of Briars", which rendered surveying more difficult.

The corner of Burford Township in the watershed contained much ash and cedar swamp, with pine, oak and "chesnut" on the drier patches. The adjoining corner of Windham contained more pine. In Norwich and Dereham many of the swamps were "Tamarac". With much of the soil being heavier, pine was found in small patches with oak and "chesnut" on the sandy ridges or scattered among the other hardwoods. Beech and maple were the most common species, but the hardwood stands contained a rich mixture of basswood, cherry, ash, elm, black walnut, butternut and hickory. Although not noted by other surveyors, Roswell Mount in his 1832 survey of Dereham makes frequent mention of swamp oak and once, just north of Tillsonburg, records "Whitewood" (Tulip). For Middleton, Malahide, Bayham and Houghton, we have more careful records made by Mahlon Burwell and his assistant, John McDonald. Although various hardwoods occurred throughout, pine, oak and "chesnut" were far more common, and the warm climate of the sand plains is evident from the frequent occurrence of "Sasafras and Hazle Bushes" and less often "Dogwood". Sycamore was common in the valleys. White pine fell roughly into three classes: "3 to 4 Ft. Diameter", "2 to 3 Ft. Diameter" and "Small", "Shrubby" or "Scrubby" pine. Mr. Burwell's opinion of the area is expressed in his letter of 1815 to Thos. Ridout, the Surveyor-General:

"There are beautiful Groves of White Pine Timber, on each side of the Creek, interspersed with Groves of other timber, alternately; there is therefore no doubt, but that ere long considerable quantities of timber will be conveyed down that Stream from Norwich & other places to the Lake."

2. Clearing the Land

The attitude of the early settler to the forest was completely hostile. Although the forest supplied his meagre needs for construction material and fuel, this was but a drop in a seemingly limitless sea of supply. Transportation was poor, and markets for his woodland produce extremely limited. For agriculture to develop the forest must go, and much of it was simply piled and burned. Settlement duties required a certain amount of land to be cleared before a patent could be obtained. After January, 1820 this obligation included the cutting of all trees on a strip 165 feet deep across the entire front of each lot.

When a new area was opened for settlement the best land was naturally taken first and the rough and swampy areas were avoided. Land was cleared first along the fronts of the farms and the woodland cut farther and farther back. toward the end of the farm which lay farthest from the road. This was done, in many cases, without reference to the quality of the soil except where it was swampy.

The accompanying table gives an estimate of the remaining woodland at various dates in the townships making up the Otter Creek area. Although slight irregularities appear in the table, due to incomplete information, the general trend of events is obvious. Until about 1910, the decrease in woodland was rapid. After that the small remaining area of woodland was at least tolerated and in some cases has probably shown a slight increase. There is not as yet any evidence of a sharp increase in woodland cover such as might be brought about by a real enthusiasm for reforestation of submarginal lands.

The figures from actual measurements made in the 1954 survey, given in the last column for comparison, refer only to that part of each township within the watershed. Due to varying topography this part may be more heavily or less heavily wooded than the township as a whole.

REMAINING WOODLAND IN PER CENT

ESTIMATED FROM CENSUS OF CANADA FIGURES

Township	1851	1861	1891	1911	1921	1931	1941	1951	1955* Survey
Bayham	77.8	55.1	26.1	10.8	12.9	15.7	12.4	16.3	20.6
Burford	65.9	54.7	16.4	8.4	8.6	9.4	8.8	10.1	26.1
Dereham	82.8	58.3	25.5	7.6	9.2	7.3	6.4	8.0	9.3
Houghton	87.8	72.8	35.9	16.0	21.5	22.4	19.2	15.3	24.2
Malahide	74.5	56.1	23.3	10.0	12.1	9.4	8.5	11.0	13.1
Middleton	89.6	75.8	36.5	16.9	20.6	20.7	18.5	16.9	17.3
Norwich North	50.9	36.1	14.2	8.9	7.2	6.8	7.0	7.4	8.4
Norwich South	78.3	63.2	22.9	12.9	9.6	9.7	6.9	7.7	10.7
Oxford East	60.8	43.3	14.0	6.6	5.4	5.9	5.4	6.1	9.2
Walsingham North	81.9	72.5	31.0	15.8	18.9	22.1	20.8	15.7	12.4
Windham	71.4	59.6	26.1	14.1	16.4	16.8	13.0	14.3	9.5
Total	74.9	58.7	24.6	9.5	12.4	12.9	11.2	11.5	15.2

* Survey figures refer only to that part of the townships within the Otter Creek area.

In part, however, these differences may simply reflect different opinions as to what should be classified as woodland. The condition of the remaining woodland is described in the following chapter.

3. Forest Products

The earliest interest in timber in Ontario was the reservation of pine and oak either by specified areas or by individual marked trees for the use of the British navy. A report of 1797 for the Township of Walsingham lists 124 lots with pine suitable for masting and 22 lots with oak suitable for the Royal Navy. Two of the pine lots and 5 with oak timber are in the section around Glen Meyer which drains into the Little Otter Creek. However, this system was already weakening when settlement in the Otter Creek area began. Otter Creek was remote from the export centre at Quebec; its main period of settlement corresponded with a period of expansion in sawmilling and increasing American markets, and it is unlikely that the Royal Navy did actually draw upon its supplies to the extent that might otherwise have been expected from the abundance and quality of its timber.

That the quality was high is affirmed by A.R.M. Lower*, who lists 10 main white pine districts in Canada and says, "The best and largest pine on record came from the peninsula district". In confirmation he quotes from a publication† of 1898: "In the region embraced by the counties of Haldimand, Norfolk, Brant and Elgin.... the quality has never been exceeded by that of any other section of the continent".

* Lower, A.R.M. The North American Assault on the Canadian Forest.

† Hotchkiss, George W. History of the Lumber and Forest Industry of the North-West.

The square timber trade commenced, no doubt, somewhat later than the mast trade and was carried on simultaneously with it from the thirties. Square timber was obtained by selecting large trees, mostly white pine, and squaring the best part into one long stick. In the earliest days of the industry the timbers were squared on all four sides to a fine "proud edge" but later, when the best timber had been cut, they were squared with a rounded shoulder or "wane" and were known as "waney timber". Such methods, of course, were wasteful since the finest grained wood was sacrificed in the operation, but this was the type of material called for by the British market.

Until 1890 the Census of Canada lists all pine and oak not sawn into lumber as "square timber", and even as late as 1910 most species are listed as "square, waney or flattened".

As already suggested, sawmilling became more important with the growth of settlement and trade on both sides of Lake Erie. Widespread agricultural development in the Otter Creek Watershed was later than in most of the surrounding area, and W.H. Smith's* description of Norfolk County in 1851 applied at least in part to Otter Creek conditions.

"In some localities the preparation of lumber engrosses more of the attention of the settlers than agricultural operations, and is likely to do so till the pine woods are exhausted, which, at the rate the destruction of the forest is now carried on, is likely to be the case in a few years; this, however, is not much to be regretted, as the improvement and cultivation of the land, and consequent enrichment of the district must necessarily follow. During the last season a great number of pine logs have been exported to the American side, sufficient to cut at least three millions feet of lumber; these, of course are sawed in the United States, to the loss of the owners of saw mills on the Canadian side of the lake; the Americans finding it more profitable to import the raw material than the manufactured article, on account of the diminished duty and other expenses. Canadian sawyers ought to see to this, as, if allowed to go on, it will necessarily increase, and in a very few years their mills will be utterly valueless to them, and the money expended in their construction will be so much dead loss."

* Smith, W.H. Canada: Past, Present and Future, Volume I.

He reports that much of Dereham, Bayham, Houghton and Walsingham was largely devoted to lumbering, but his hopes for change are obvious in his description of the road between "Tilsonburg and Sandytown" (now Straffordville):

"This neighbourhood being almost altogether a lumbering country will account for the scarcity of improvements; as, however, the land becomes cleared of its best timber, and lumbering remains no longer profitable, those engaged in the trade will of necessity turn their attention to agriculture, and good farms will supply the place of saw mills."

In the meantime Otter Creek was "the principal mill stream in the county", and Smith records 29 sawmills in Bayham Township alone. Exports from Port Burwell, "the shipping port for the great lumbering country on the Otter Creek and its tributaries", had increased from about 3,000,000 feet of sawed lumber in 1846 to 8,424,154 feet in 1849. "The principal portion of the lumber is shipped to Oswego, Buffalo, Cleveland and Huron." Fort Burwell itself had "a steam saw mill, with three saws, capable of cutting one million feet of lumber per annum".

Large quantities also came from the mills upstream and particularly from "Vienna, which is the head quarters of those engaged in the lumber trade of the district". Vienna had three sawmills, but most important was the fact that:

"The Otter Creek is navigable for scows to Vienna, three miles from the port. These scows carry from fifteen thousand to twenty-five thousand feet of lumber, which they place on board the schooners at the port; for which they receive about half a dollar per thousand feet."

Although the peak of production for many products was not reached for some time, temporary and local changes are illustrated by the remark that:

"Formerly, large quantities of staves were shipped from Fort Burwell, but the oak timber within convenient reach having been used up, the exportation of staves has gradually diminished, till at length it has almost altogether ceased..."

FOREST PRODUCTS - ESTIMATED FROM CENSUS OF CANADA FIGURES

COUNTY OF ELGIN

Products	Species	Unit	1870	1880	1890	1900	1910	1920	1930	1940	1950
Pulpwood		Cords			255	12					
Tanbark		"	275	37	115	16					
Lathwood		"	1,600	243	20						
Masts & Spars		Number	8	292	98						
Staves		"	821M	1,136M	51M	\$1,219	\$ 255				
Fence Rails		"						513	1,828		
Fence Posts		"			60,504	25,460	6,570	10,990	11,253		1,767
Poles		"				58	200		250		33
Railway Ties		"			24,566	550					
Piling		"				283	140				
Shingles		"			2,262M						
Fuel Wood		Cords	117,727	149,952	145,396	171,028	89,613	81,620	59,004	48,352	12,753
Square Timber & Logs	Ash	Cu. Ft.				8,474	6,890				
	Birch & Maple	"	9,100	136,560	125	7,680	53,685				
	Black Walnut	"	26,533	4,994	5,400						
	Butternut	"	4,237	6,569	1,240						
	Elm	"	61,872	64,127	146,776	15,271	4,563				
	Hickory	"	5,334	48,025	61,947						
	Oak	"	70,745	165,116	24,522	8,722	4,400				
	Pine	"	2,669	165,819	36,528	2,893	15,075				
	Tamarack	"	136,933	7,330	100						
	Others	"	82,981	737,857	53,598	14,994	7,478				
Lumber	Pine	M bd. ft.	1,479	3,728	2,157	1,067	377)	444	668		402
	Others	"	5,023	19,291	24,725	12,551	3,278)	5,635	1,305	16,388*	4,659
Other Products		\$									

* Includes lumber, posts and poles

M = Thousand (1,000)

FOREST PRODUCTS - ESTIMATED FROM CENSUS OF CANADA FIGURES

COUNTY OF NORFOLK

Products	Species	Unit	1870	1880	1890	1900	1910	1920	1930	1940	1950
Pulpwood		Cords			215	20					
Tanbark		"	443	200	171	33					
Lathwood		"	3,259	1,306	348						
Masts & Spars		Number	545	81	206	6					
Staves		"	1,492M	1,178M	757M	\$1,890	\$1,890				
Fence Rails		"						130	3,790		
Fence Posts		"	,	.	113,199	91,457	29,060	24,969	18,908		2,231
Poles		"			2,863	800	670		164		42
Railway Ties		"			77,216	140	1,102	4,352	850		
Piling		"				1,141	90				
Shingles		"			4,351M						
Fuel Wood		Cords	92,127	99,297	146,467	140,766	68,987	67,097	48,164	45,892	15,544
Square Timber & Logs	Ash	Cu.ft.				3,352	17,000				
	Birch & Maple	"	250	5,650	10,150	3,312	62,800				
	Black Walnut	"	100	11,450	2,600						
	Butternut	"		5,430							
	Elm	"	32,630	4,715	22,223	7,264	103,157				
	Hickory	"		4,694	9,125						
	Oak	"	200,666	528,003	198,123	1,001	4,000				
	Pine	"	30,643	93,961	1,122,123	6,993	10,242				
	Tamarack	"	3,560	208,719	4,320						
	Others	"	364,569	990,980	84,065	10,120	12,000				
Lumber	Pine	M	5,416	36,257	6,340	2,315	2,340)	2,259	1,115		446
	Others	M	614	9,779	7,795	10,025	6,567)				
Other Products		\$					304	1,475	1,434	16,079*	14,324

* Includes lumber, posts and poles

M = Thousand (1,000)

FOREST PRODUCTS - ESTIMATED FROM CENSUS OF CANADA FIGURES
COUNTY OF OXFORD

Products	Species	Unit	1870	1880	1890	1900	1910	1920	1930	1940	1950
Pulpwood		Cords									
Tanbark		"	588	444	106	79					
Lathwood		"	193	37	84						
Masts & Spars		Number		226	8		9				
Staves		"	634M	1,704M	81M	\$1,810	\$ 23				
Fence Rails		"						4,130	1,920		
Fence Posts		"			56,309	32,304	10,542	12,815	14,749		3,084
Poles		"			51	313	79	15	516		56
Railway Ties		"			3,005	25	50				
Piling		"				37					
Shingles		"			217M						
Fuel Wood		Cords	142,282	165,199	157,571	128,640	61,311	73,816	49,203	38,973	9,177
Square Timber & Logs	Ash	Cu.Ft.				2,824	800				
	Birch & Maple	"	3,545	29,663	8,427	2,624	4,718				
	Black Walnut	"	300		300						
	Butternut	"	1,436	1,000	4,850						
	Elm	"	166,196	78,025	46,522	98,457	25,382				
	Hickory	"	7,850	5,472	11,000						
	Oak	"	41,950	60,921	5,345	4,368	1,550				
	Pine	"	13,878	14,209	50,401	3,022	4,000				
	Tamarack	"	52,525	58,291	19,895						
	Others	"	91,557	116,168	40,337	6,881	4,000				
	Pine	M	3,579	10,502	5,576	331	178)	888	641		386
	Others	M	1,216	16,454	28,977	4,105	2,658)				
Other Products		\$				20	96	100	731	14,315*	215

* Includes lumber, posts and poles
M = Thousand (1,000)

The census of 1851-2 shows a continued advance, with 38 sawmills in Bayham Township reporting a production of 25,570,000 feet. No doubt some of this was reflected in further increased shipments from Port Burwell, but it is to be expected that large quantities also found their way north to Ingersoll and Woodstock.

From 1840 to 1870 a large amount of lumber and squared timber was used for local construction, and particular species were in demand for the manufacture of vehicles, furniture, barrels and woodenware. By the latter date local building had slackened off. The making of vehicles continued until the nineties.

A study of the accompanying tables of forest products reveals many changes. While the varying basis used for Census of Canada returns at different periods makes comparisons difficult, some general trends are quite clear. The peak production shown for most products is in 1880 or 1890. Soon after 1900 such products as tanbark, lathwood, masts, staves, shingles and piling drop from the list, and production of other products shows a sharp decline. The one product which has persisted throughout the record is fuelwood, which has dropped from a peak of 440,434 cords in 1900 to a low of 37,474 cords in 1950. This decline reflects both the decrease in available supply and the increasing competition of other fuels.

The addition in 1890 of fence posts, poles and railway ties reflects the development of the area. The introduction of wire fencing, the development of the telephone and the expansion of telegraph service all stimulated forest production at this period. The subsequent sharp decline in these products shows the rapid depletion of supplies.

Tamarack was an important timber until 1890 when the species was almost wiped out by the depredations of the larch saw-fly. Walnut, butternut and hickory were

MAPLE PRODUCTS CALCULATED AS SYRUP

FROM CENSUS OF CANADA FIGURES

County	1851 Gals.	1861 Gals.	1871 Gals.	1881 Gals.	1891 Gals.	1901 Gals.	1911 Gals.	1921 Gals.	1931 Gals.	1941 Gals.	1951 Gals.
Elgin	21,375	35,062	30,590	23,189	29,108	21,846	27,527	8,151	13,252	6,757	2,465
Norfolk	9,299	15,601	7,909	7,057	15,821	16,703	10,104	4,097	4,401	3,665	1,665
Oxford	32,095	53,837	42,510	14,288	24,047	22,902	38,283	17,931	16,710	9,728	5,900
Total	62,769	104,500	81,009	44,534	68,976	61,451	75,914	30,179	34,363	20,150	10,030

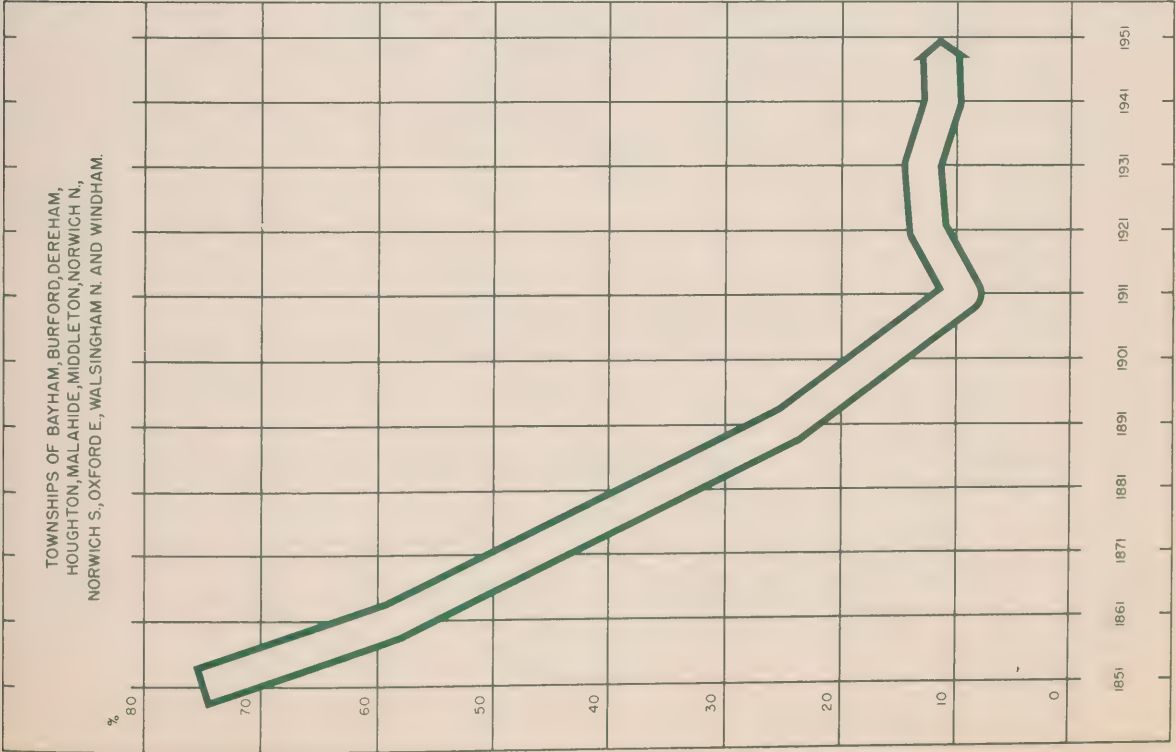
important for their special uses, but after 1890 they no longer appear as separate species in the record.

In 1920 no square timber is shown, and from this time on lumber production is small and is no longer separated by species.

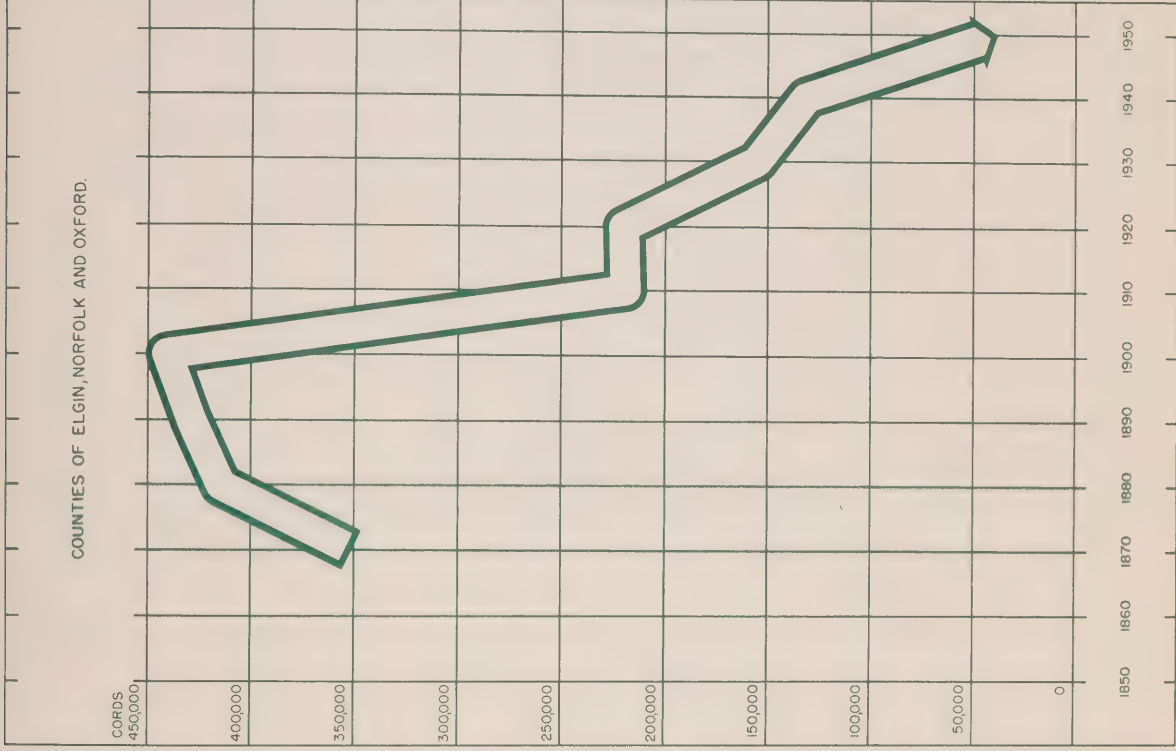
Potash shipped to Britain for use in soap making and the dyeing industry was a source of some revenue while land was being cleared. It was extracted from the ashes of hardwood trees, 60 large maple trees producing one barrel of 650 pounds. While family and local village asheries were common in Ontario, only the large commercial plants were recorded. The 1851 census lists one soap factory in Elgin County and one ashery (at Aylmer), a soap factory in Norfolk County and an ashery in Oxford County.

Maple sugar was almost the only sugar available to the pioneers. In 1910 census records begin to list maple syrup as well, indicating the change from a pioneer necessity to a modern luxury. For the sake of comparison the accompanying table shows these products expressed as an equivalent amount of syrup. Production in 1951 was less than 10 per cent of that for the peak year of 1861.

PER CENT WOODLAND

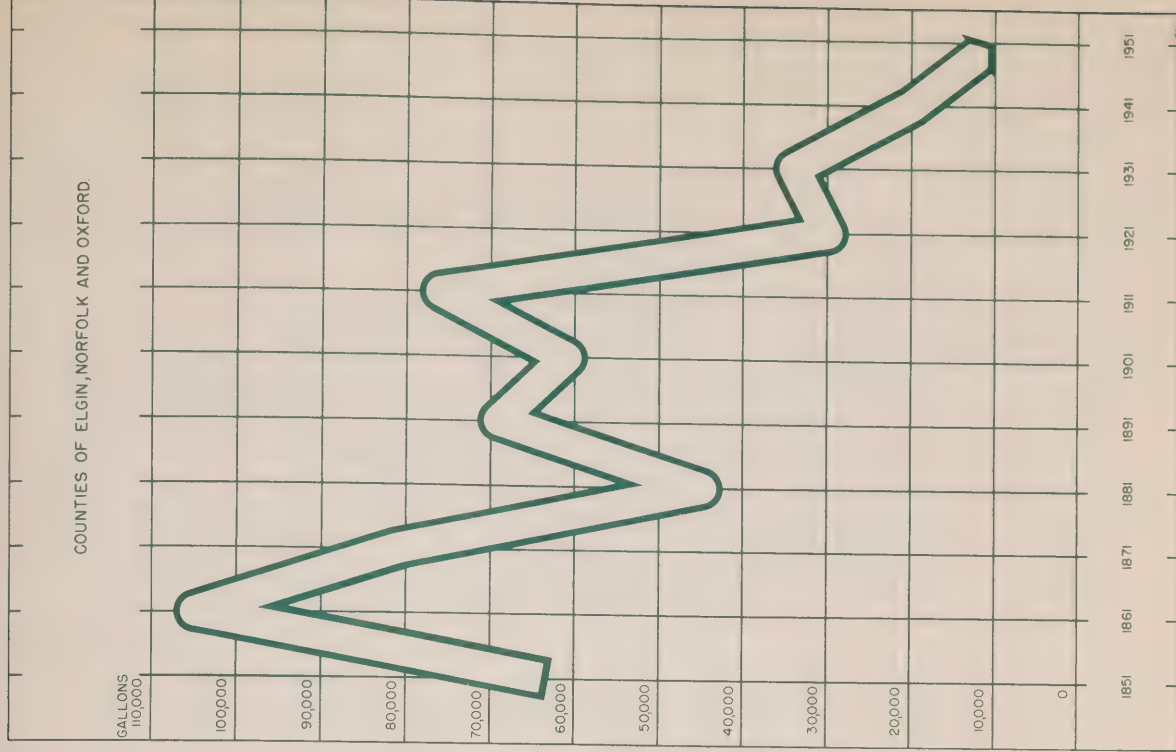


FUELWOOD PRODUCTION



MAPLE PRODUCTS

(EXPRESSED AS GALLONS OF SYRUP)



CHAPTER 2

SURVEY OF PRESENT WOODLAND

An accurate inventory of the existing woodland in the watershed and an estimate of its present condition is a basic necessity in establishing a woodland conservation program. A detailed study was consequently made of all woodlands, scrubland, plantations and land which is suitable for reforestation.

The Otter Creek Watershed lies entirely within the Deciduous Forest Region*, the boundary of which passes close to its northern limits. The Deciduous Forest Region enjoys a very moderate climate modified by being bounded by the Great Lakes Ontario, Erie and Huron. Though the forest in this Region consists primarily of beech and sugar maple together with basswood, red maple, red, white and bur oak, a large number of other species, many of small size, find their northern limit here. Among these are chestnut, tulip tree, pignut hickory; black, pin, chinquapin and chestnut oaks; black gum, blue ash, magnolia, papaw, Kentucky Coffee tree, red bud, red mulberry and sassafras. In addition, within this region is the main distribution in Ontario of black walnut, sycamore, swamp white oak and shagbark hickory, together with the more widely distributed butternut, bitternut hickory, rock elm, silver maple and blue beech. In general coniferous species are poorly represented, but white pine is abundant locally on the lighter soils.

1. Survey Methods

Aerial photographs, each covering about 1,000 acres, were provided to the forestry party, and mapping in the field was done directly on the photographs. Each area of woodland, scrubland, swamp and rough land was visited and

* Halliday, W.E.D. A Forest Classification for Canada. 1937.

described as to acreage, cover type, presence of grazing, reproduction and average diameter at breast height.

Each woodlot was classified as hardwood, coniferous or mixed. The term "hardwood" is used to denote all broad-leaved trees regardless of their physical hardness. A woodlot in which 80 per cent or more of the trees are hardwoods is called a hardwood stand, one in which 80 per cent or more of the trees are conifers is called a coniferous stand, and all other stands are classed as mixedwood.

Plantations were likewise examined and records made of method of planting, approximate age, care, damage and survival.

Land suitable for reforestation was mapped and descriptions prepared in some detail for the larger areas.

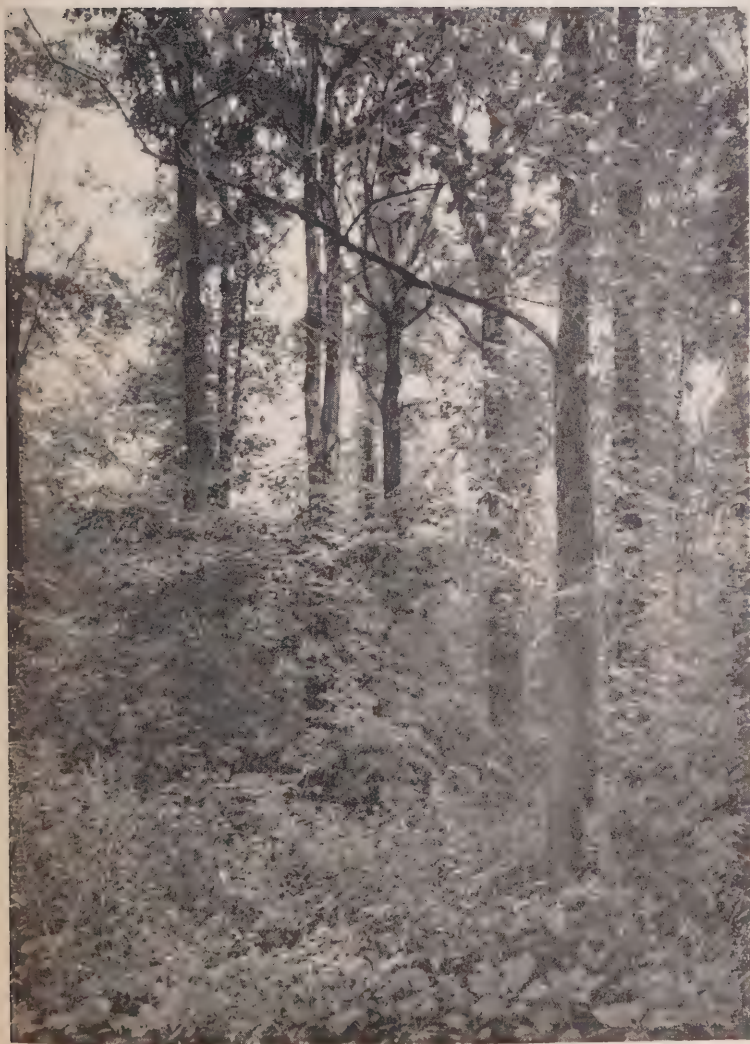
2. Forest Cover Types

The term "forest cover type" refers to those combinations of tree species now occupying the ground, with no implication as to whether these types are temporary or permanent. A slightly modified form of the system drawn up by the Society of American Foresters has been used on this survey so that the system will adequately describe the cover types common to the watershed. The gaps in the numerical system are due to certain cover types common to the eastern United States which do not enter Canada.

The following cover types were encountered on the Otter Watershed:

<u>Type Number</u>	<u>Name</u>
4	Aspen
4a	Poplar -- oak
5	Pin cherry
8	White pine - red oak - white ash
9	White pine
10	White pine - hemlock
11	Hemlock
12	Sugar maple - beech - yellow birch
13	Sugar maple - basswood
14	Sugar maple
14a	Black cherry
24	White cedar
25	Tamarack

*The beech — hard maple type
once occupied most of the loamy
and heavier soils and is still the
most abundant type on the water-
shed.*



*Silver maple — white elm swamps
form natural reservoirs at the
headwaters of many streams.*

<u>Type Number</u>	<u>Name</u>
26	Black ash - white elm - red maple
45	Bur oak
47	Black locust
49	White oak - black oak - red oak
49a	White oak - black oak - hickory
50	White oak
51	Red oak - basswood - white ash
57	Beech - sugar maple
58	Beech
59	Ash - hickory
60	Silver maple - white elm
60a	White elm
61	Cottonwood
88	Willow

So many of these types occur in appreciable amounts that the woodland is extremely varied, and no one type predominates. The most abundant type, beech - sugar maple, makes up 25.7 per cent of the woodland acreage. Flat or mildly rolling terrain in much of the watershed has encouraged clearing of all but the wetter areas. As a result the various swamp hardwood types, now comprising 27.3 per cent of the woodland, appear more prominent than they did in the original forest. Types containing pine or hemlock in appreciable quantities amount to 13.9 per cent and various oak types to another 8.8 per cent of the woodland. Aspen, a temporary type following fire or other disturbance, covers 8.3 per cent of the wooded area.

Briefly, the cover types found on the watershed may be described as follows:

- Type 4 - Aspen is a pioneer type coming in after fire or overgrazing. Though it avoids the wettest swamps, it does grow on soils that are wet throughout a good part of the year, as well as on dry soils.
- Type 4a - Poplar - oak is a residual type on light soils following logging and fire. The type usually consists of trees of white, red and sometimes bur oak which have survived due to their resistance to fire, and poplar which has seeded in later. The site is usually a white pine site and scattered trees of

this species frequently occur, with patches of good white pine reproduction appearing through the area.

Type 5 - Pin cherry is a pioneer cover type after cutting or fire.

Type 8 - White pine - red oak - white ash occurs on moist but well-drained soils. Red maple is the most common associate, but a number of other species may be present.

Type 9 - White pine may occur on a variety of soils but maintains itself best on light, sandy areas.

Type 10 - White pine - hemlock favours cool locations such as the slopes of ravines.

Type 11 - Hemlock, similar to above type, but with hemlock predominant over any single associate.

Type 12 - Sugar maple - beech - yellow birch is most commonly found on loamy soils along the valleys.

Type 13 - Sugar maple - basswood also favours loamy soils. This type is limited in area, but the value of its two main species gives it some importance.

Type 14 - Sugar maple undoubtedly was an important part of the original forest of the watershed, but since it occupied fertile, well-drained soil with good moisture, much of it has been cleared for agriculture.

Type 14a - Black cherry occurs in small patches on fertile, well drained soils; a temporary type following clear-cutting.

Type 24 - White cedar, formerly more widespread, occurs now mainly on muck soils of swamps in Norwich South and is practically absent from the rest of the watershed.

Type 25 - Tamarack occurs in a few small patches on cool muck swamps.

Type 26 - Black ash - white elm - red maple forms the wetter hardwood swamps often important to headwaters of streams.

FOREST COVER TYPES

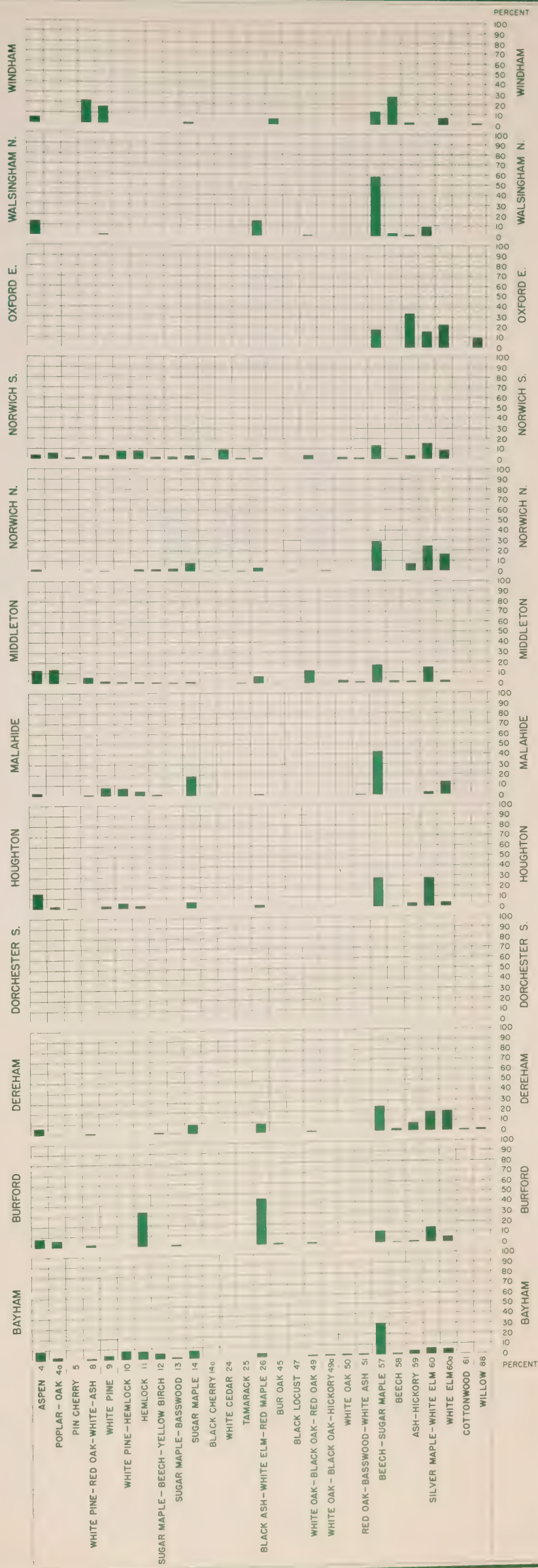
Township	Acres	4	4a	5	8	9	10	11	12	13	14	24	26	45	49	49a	50	51	57	58	59	60	60a	61	88
Oxford E.	84																		15		28	14	19		8
Norwich N.	2495	25			15	15		36	34	56	206	5	85			22		5	738		187	615	422		11
Norwich S.	2988	127	167	17	56	103	243	239	62	63	97	282	42		118		44	35	393	26	108	453	277		3
Dereham	2880	192	11		29				34	11	238		236		20				705	58	210	518	536	26	56
Dorchester S.	-																								
Burford	1689	134	103		31	7		56			22		760	24	13				191	7	16	239	86		
Windham	167	9			37	27					2			9					21	46	3		11		2
Malahide	1009	19			7	79	70	46	6		190		5					4	431			24	128		
Bayham	11398	953	331	4	136	473	906	876	607	127	838	4	427		63	76	133	121	3517	150	388	676	524	29	34
Middleton	4476	577	602	14	257	80	56	44	32	16	62		298	9	541	5	124	43	776	76	53	689	88	15	12
Houghton	3034	447	55	13		66	156	70			167		70		2	7			857	9	104	873	130		4
Walsingham N.	418	56				5							61		2				243	9	3	39			
Total	30638	2539	1269	48	568	855	1431	1367	775	273	1822	291	1984	42	759	110	301	208	7887	381	1100	4140	2221	70	130
Per Cent	100	8.3	4.1	0.2	1.9	2.8	4.7	4.5	2.5	0.9	5.9	1.0	6.5	0.1	2.5	0.4	1.0	0.7	25.7	1.2	3.6	13.5	7.3	0.2	0.4

Three other types occur as traces, each constituting less than 40 acres of woodland. These are:

Type 14a - 13 acres
 " 25 - 39 acres
 Type 47 - 15 acres

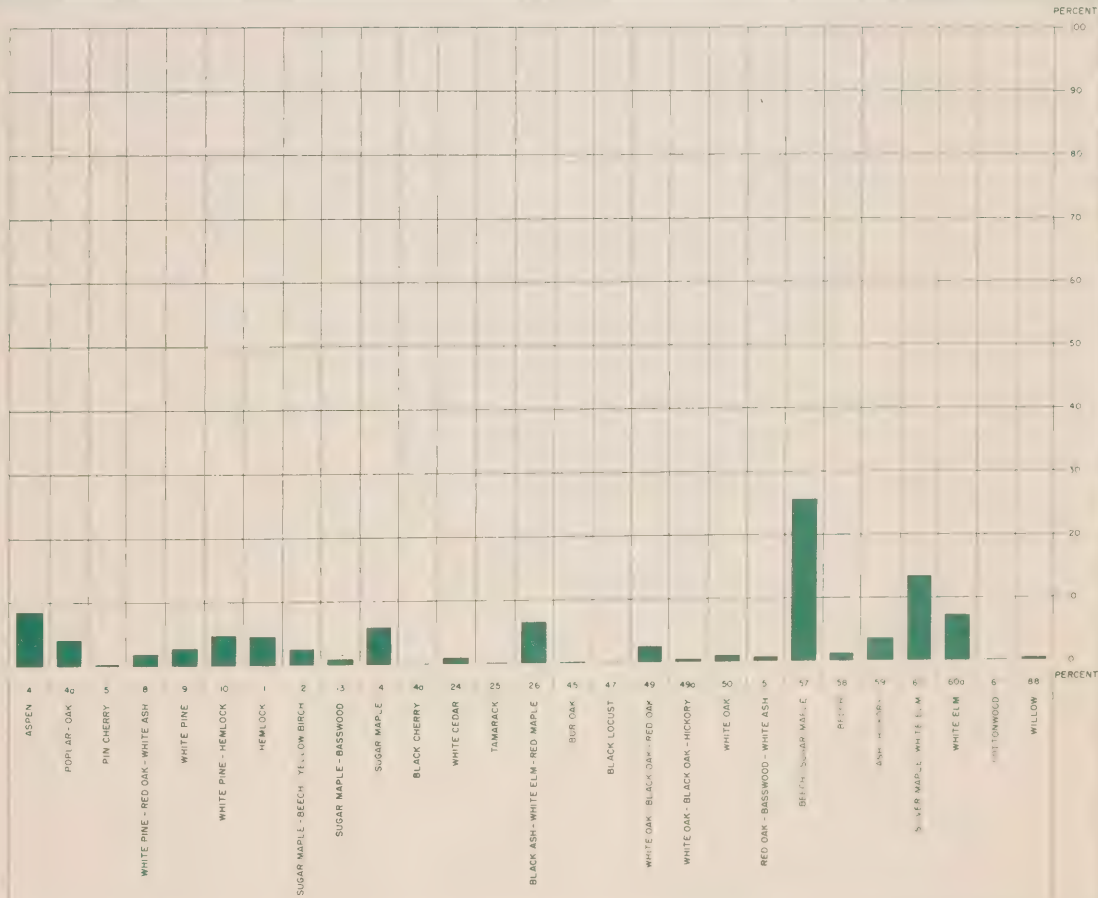
- Type 45 - Bur oak is an uncommon type in Ontario. It occurs in small patches on loamy slopes with a south or south-west exposure.
- Type 47 - Black locust, not native but may escape from plantations. Prefers dry, limy soils.
- Type 49 - White oak - black oak - red oak is important on light soils, particularly in Middleton and Norwich South.
- Type 49a - White oak - black oak - hickory is similar to the previous type but much more limited in occurrence.
- Type 50 - White oak also occurs on light soils in the east central part of the watershed.
- Type 51 - Red oak - basswood - white ash usually requires somewhat better and moister soils than the other oak types.
- Type 57 - Beech - sugar maple is regarded as the typical climax type on the loamy or heavier soils of the region. Associated with the type species are red maple, white oak, red oak, hemlock, white elm, red elm, basswood, shagbark hickory and black cherry. In spite of clearing, this is still the most abundant type in most parts of the watershed.
- Type 58 - Beech occurs mostly on the heavier soils.
- Type 59 - Ash - hickory is usually a residual type following cutting and grazing, often of Type 60 stands.
- Type 60 - Silver maple - white elm is a type of poorly drained soils unsuitable for general farming unless completely and adequately underdrained; for this reason it and the similar white elm Type 60a have survived better than forest cover types on better drained land. Associated species are red maple, slippery elm, cottonwood, white, red and green ash, bur oak and bitternut hickory. It is the second most abundant type in the Otter Creek area.

PERCENTAGE BY TOWNSHIP
1955



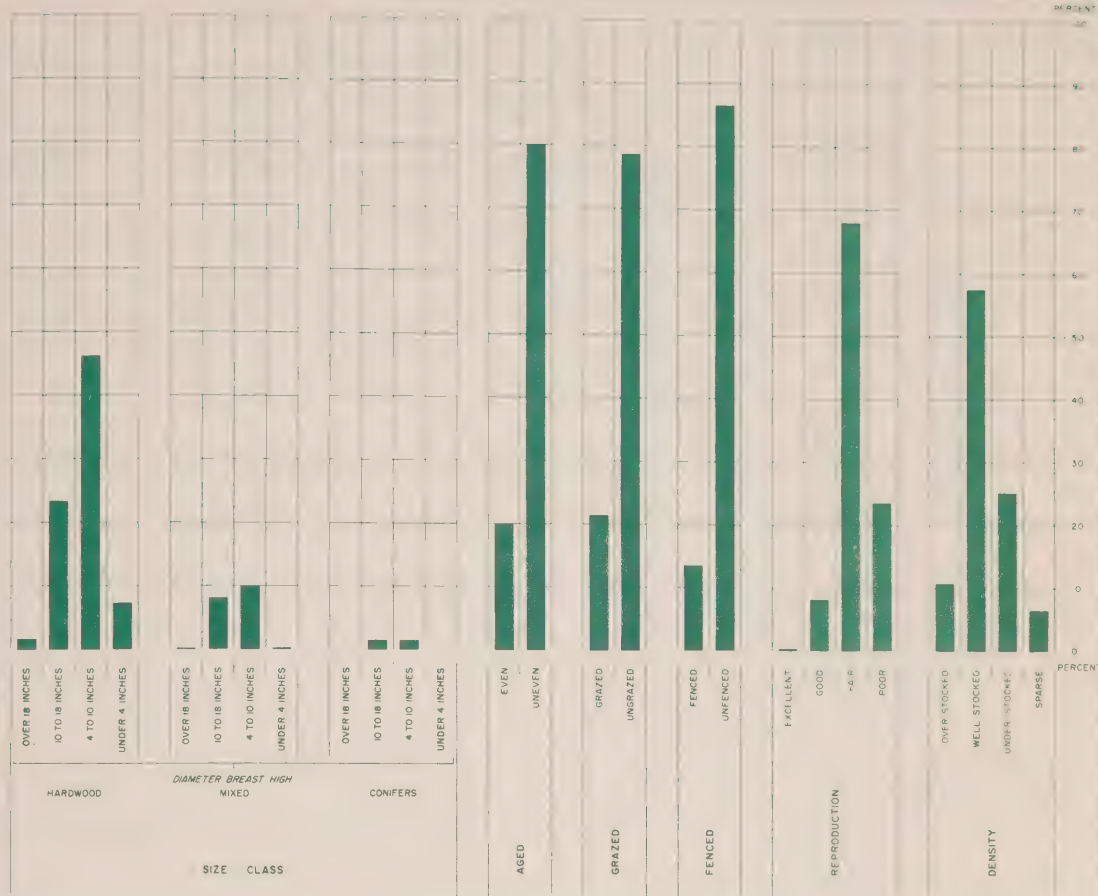
FOREST COVER TYPES

PERCENTAGE OF TOTAL WOODLAND
1955



WOODLAND CONDITIONS

PERCENTAGE OF TOTAL WOODLAND
1955



Type 60a - White elm is similar to the previous type but with white elm predominating and other species occurring as minor associates. It is found on drier sites as well as in the swamps.

Type 61 - Cottonwood occurs as small patches, usually in river bottoms.

Type 88 - Willow occurs on wet sites along stream banks or around ponds.

3. Condition of Woodlands

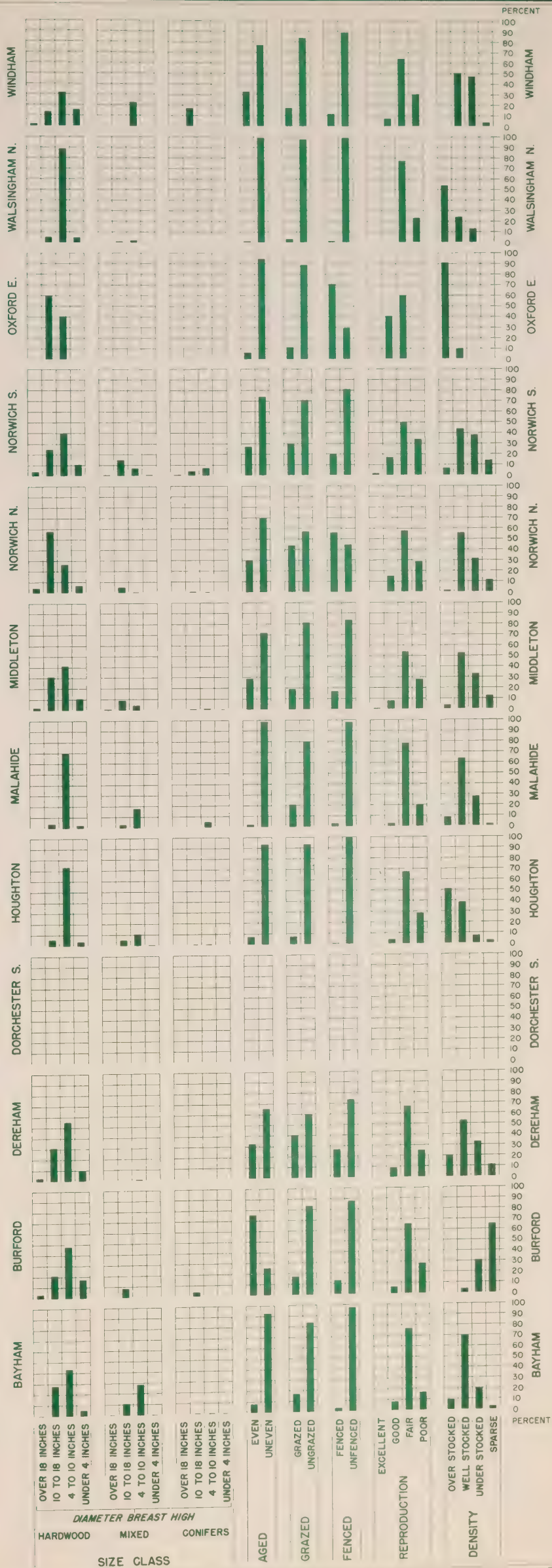
Conditions revealed by the survey are shown in some detail in the accompanying tables and graphs.

Woodland within the watershed comprises 30,638 acres, which is 15.2 per cent of the total area of 202,222 acres. Of this woodland 78.5 per cent is classed as hardwood stands, 18.5 per cent as mixedwood and only 3.0 per cent as coniferous. There is no doubt that conifers originally formed a larger part of the woodland than they do today, but their numbers were diminished because of the desirability of the lumber they furnished and recurrent fires which have destroyed them while more fire-resistant species such as oak have survived. In addition, much of the best pine land is also well suited to tobacco farming and is now used for that purpose.

Very little of the present woodland is mature and merchantable. Only 1.8 per cent, practically all hardwood, is classed as over 18 inches diameter breast height. Coniferous stands between 10 and 18 inches, a size suitable for poles, make up only 1.5 per cent. The 7.5 per cent of young stands, under 4 inches diameter breast height, and the 56.2 per cent of hardwoods and mixedwood between 4 and 10 inches will require some time to grow to merchantable size. This time may be shortened by thinning the stands where necessary. The remaining hardwoods and mixedwood between 10 and 18 inches diameter (31.5 per cent) and conifers 4 to 10 inches (1.5 per cent) will soon be large enough to provide

WOODLAND CONDITIONS BY TOWNSHIPS

PERCENTAGE BY TOWNSHIP
1955



some merchantable material and should pay for proper management in a relatively short time.

The survey indicates that 80 per cent of the woodland is uneven-aged and therefore might readily become a source of continuous revenue to the owner. However, this continuous production will not last for long unless there is an improvement in natural regeneration in the woodlots. Nearly one-quarter of the woodland area shows virtually no regeneration. Less than 9 per cent showed regeneration which could be classed as "good" to "excellent". Fires, considered as unimportant by many woodland owners, are one cause for this condition. The grazing of 21.4 per cent of the woodland is another serious factor. Very few woodlots are protected against cattle, and only the lack of livestock in the tobacco areas prevents more widespread grazing damage.

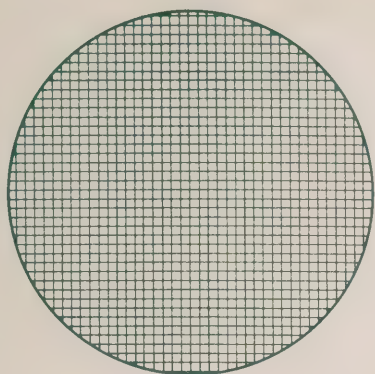
Slightly over half the woodland has about the desired degree of stocking, and one-tenth is definitely overstocked and needs thinning for improved growth. The rest is understocked or sparse, requiring planting or at least protection to bring it back to a fully stocked condition.

4. Scrublands

In all 2,530 acres in the watershed are covered with tree species which never attain commercial size. The most common species are scrub willow and dogwood on poorly drained sites and hawthorn and sumach on dry sites. In some cases this land can be improved for agriculture through drainage or through eradication of dry scrub. However, where such restoration does not seem economically feasible, the area should be returned to tree cover through systematic replacement of the scrub species with more valuable species.

SCRUBLANDS

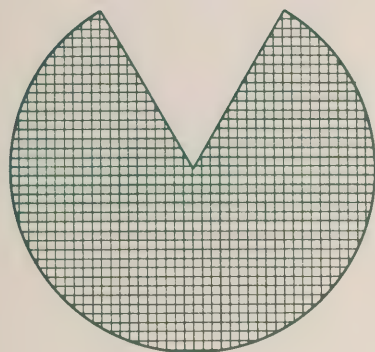
Township	Area in Watershed (Acres)	Scrub			
		Dry (Acres)	Wet (Acres)	Total (Acres)	Total % of Twp. Area
Oxford E.	911	-	-	-	0.0
Norwich N.	29,606	92	88	180	0.6
Norwich S.	27,994	132	72	204	0.7
Dereham	30,893	129	55	184	0.6
Dorchester S.	160	-	-	-	0.0
Burford	6,470	234	-	234	3.6
Windham	1,754	9	-	9	0.5
Malahide	7,702	9	61	70	0.9
Bayham	55,213	357	539	896	1.6
Middleton	25,862	176	159	335	1.3
Houghton	12,557	263	56	319	2.5
Walsingham N.	3,100	38	61	99	3.2
Total	202,222	1,439	1,091	2,530	1.3



TOTAL AREA OF WATERSHED

202,222 Acres

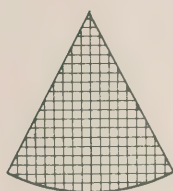
(100 %)



OPEN LAND

169,054 Acres

(83.5 %)



WOODLAND

30,638 Acres

(15.2 %)



SCRUBLAND

2,530 Acres

(1.3 %)

W.J.C.

LAND CLASSIFICATION — TOTAL WATERSHED

CHAPTER 3

MARKETS AND MARKETING

Considerable information about markets for local woodland products has been gathered by the Erie District office of the Department of Lands and Forests at Aylmer. This information, together with observations made during the woodland survey, supplies a general picture of marketing conditions in the Otter Creek Watershed.

For quality products, such as veneer logs, buyers will come one hundred miles or more. For low grade material ten miles may be the limit, and often it is difficult to find a buyer at all. On the other hand, some woods are brought into the area which might be purchased locally if they were grown there in the quantity and quality required.

In many parts of Ontario the truly portable mill, moving to the woodlots it cuts, has disappeared before the impact of better roads and improved truck-hauling to stationary mills. In the Otter Creek area portable mills have persisted. Frequently such mills depend on custom sawing for woodlot owners, the quality of lumber sawed is low and the mills operate only a few days to a few months each year.

As elsewhere, one of the most serious problems is the lack of an adequate market for small or low grade material, which should be removed to improve the growth of quality material in the woodlot. The market for fuelwood for domestic use or tobacco kilns has declined sharply in the face of competition from other fuels, but this use still remains of some importance. A pulpwood market for thinnings from pine plantations is already well established. No such market for hardwood thinnings exists as yet, but recent advances in the pulp and paper industry make it reasonable to expect such a development within the next few years. This type of market does not promise large returns to woodlot owners, but it does

promise to defray the cost of woodlot improvements which will allow the progressive owner to produce the quality products from which his real profits are derived.

The importance of quality products was well illustrated by a news release from the Erie District office, which is quoted in part below:

"There is no commodity produced on a farm which will vary as much as wood...Our woodlots and pine plantations in Southern Ontario yield a variety of products. In order to compare their relative values, it is necessary to arrive at a price per cubic foot of wood for each product. The following prices should not be taken as exact, as they will vary with quality, quantity, ease of logging and the bargaining power of the landowner. However, these prices will serve to show a comparison of net values from various products. Fuelwood, at \$1.00 per short cord is worth about 4 cents per cubic foot. Pulpwood from pine thinnings @ \$2.00 per full cord is worth about $2\frac{1}{2}\text{¢}$ per cubic foot. Small pine logs from 6 - 8" in diameter at 3¢ per running foot are worth about 9¢ per cubic foot. Cedar posts 8' long, having a 5" top at 20¢ each are worth about 10¢ per cubic foot. Small sawlogs 10 - 15" in diameter, of valuable species, such as hard maple, oak, ash, etc., at \$40.00 per thousand board feet, Doyle Rule, are worth about 16¢ per cubic foot.

"Large sawlogs of less valuable species, such as elm, beech, soft maple, averaging 20" in diameter, and valued at \$25.00 per thousand, Doyle Rule, are worth about 17¢ per cubic foot.

"Good quality sawlogs of hard maple, pine, oak, etc., averaging 20" in diameter at \$60.00 per thousand board feet, Doyle Rule, are worth about 40¢ per cubic foot.

"Veneer quality logs of maple, oak, cherry, etc., averaging 22" in diameter at \$90.00 per thousand board feet, Doyle Rule, are worth 65¢ per cubic foot."

Besides giving attention to the growing of more and better woodland products, any woodlot owner should know enough about harvesting and marketing to get the most out of his present and future production.

1. The Timber Harvest

Harvesting of timber involves four operations: estimation of volume, cutting, skidding and hauling. The owner may perform all operations, selling his logs at the

mill; he may cut and skid the logs, selling them at the roadside; or he may sell his timber on the stump.

(a) Estimating

Estimation of timber may be done either in the tree (cruising) or in the log after cutting (scaling).

Some operators cruise timber by rough ocular estimate; that is, by walking through the bush and estimating, on the basis of past experience, the number of board feet in the stand. The most accurate method would be to measure each tree, consider taper and defect, estimate and tally its volume. In large wooded tracts only a representative sample, say 10 per cent or 20 per cent, may be measured and the total estimated from this sample.

One example may illustrate the value of a tallied cruise. Some years ago, in competitive bidding for 87 acres of woodland, one operator estimated a stand, by tallying every merchantable tree, to be 700,000 board feet; the chief log buyer for a large furniture manufacturer estimated 350,000 board feet; another operator estimated 100,000 board feet. The actual cut from the stand was 746,000 board feet. Obviously such discrepancies are of concern to the seller as well as to the bidder who tries to maintain his place in competitive buying. Before selling standing timber, it would pay the owner to make a tallied cruise or, if necessary, to hire professional assistance for this purpose.

Similarly, when selling logs, the owner or his agent should assist in their measurement, try to understand the allowance which must be made for defects and assure himself that he is being fairly treated.

(b) Cutting and Skidding

In a typical hardwood operation, the value of logs at the roadside may be half as much again as that of logs in the standing tree. The difference is mainly labour cost.

By performing the operations of cutting and skidding, the farmer increases his return by selling his

labour and use of his equipment instead of just his stumpage. The flexibility of woods work in fitting into otherwise slack seasons on the farm should make this increased return particularly attractive. In addition, the farmer doing his own cutting is best able to determine that the right trees are removed and damage to the remaining stand kept as low as possible.

(c) Hauling

Truck-hauling has increased the distance from which mills can secure their logs. Cost per thousand board feet hauled depends largely on distance. Thus, while grade 1 logs might be hauled up to 50 miles, the lower value of other logs might limit practical hauling distance to 15 or 20 miles.

While actual figures will vary greatly, the example below will suggest the change in log value at various stages.

Value of logs in the tree				
(stumpage)	\$28	per	M	board feet
Making logs from tree	8	"	"	"
Skidding logs to road	6	"	"	"
Hauling logs to mill	8	"	"	"
Value of logs in mill yard	\$50	"	"	"

2. Timber Sales

(a) Outright Sale of Woodlot

Frequently a sawmiller finds the simplest procedure is to buy the woodlot or farm outright. In this case, the former owner has no further interest in the land. The practice of slashing such woodlots and leaving them to become tax-delinquent was legitimate cause for community concern. Where tree cutting by-laws are rigidly enforced, this abuse should be kept under control.

(b) Sale of Cutting Rights

Under this method the owner sells the right to cut all timber of certain species down to a certain diameter; or the trees to be cut may be marked in advance and the sale made on this basis. Often only a very vague word-of-mouth agreement is made and misunderstandings are common. A simple written agreement such as that suggested later in this chapter would avoid this confusion.

A lump-sum method of payment is often used on such sales, based upon a volume estimate by the buyer. As mentioned in the section on cruising, the volume estimates of different bidders may vary considerably. The seller is therefore advised to consult the list of buyers of woodland products in the hands of the Zone Foresters and to obtain competitive bids from as many buyers as possible. On lump-sum purchases the buyer takes all the risk as to accuracy of estimate and quality of timber.

Selling the standing timber at a rate per thousand feet removes the uncertainty of volume estimates and requires measurement of the logs after cutting. Two uncertainties remain - the log rule to be used in measurement and the assignment of logs to different grades which differ in prices per thousand board feet. For Provincial Government transactions the new Ontario Log Rule is now required, but for private sales there is no set standard, the Doyle Rule being most commonly used. The woodlot owner seldom knows the problems of processing logs into lumber sufficiently well to understand fully why the buyer assigns some logs to lower grades. Publication of price lists and grade specifications by log buyers would promote better relations with woodlot owners. Possible arguments and ill feeling over these matters are factors in making some buyers prefer lump-sum purchase. The woodlot owner must decide whether to accept volume and grade risks in the hope of getting a better price by selling on a log measurement basis.

In the event that he chooses to be paid on a volume-removed basis, just what the buyer intends to cut and pay for should be absolutely clear. Only the best trees might be removed, and it is possible that only the best logs from these trees might be taken. This leaves the owner with many poor quality logs which he cannot readily sell and with some poor trees standing which he wanted cut. The volume actually paid for might be small, and the woodlot owner's total realization on the transaction might be less than he would have received had he accepted payment in a lump sum.

No matter which of these two methods is chosen, a written Timber Sale Contract should cover the transaction. It should set forth all the details necessary as to prices, species, sizes, rights granted to the buyers, limiting dates, times of payment and so on.

(c) Owner-Made Logs

The woodlot owner who has decided to realize not only the value of his woodland product but also the additional labour income derived from its harvest prefers to take payment at a price per thousand board feet for logs placed on skids at the roadway or logs delivered to the mill. Here again the securing of competitive bids and a clear understanding with the buyer regarding log grade will avoid any feeling of unfairness in the deal. An owner who simply arrives at the mill with a load of logs may feel that he has to accept the offered price even though he is dissatisfied.

3. Timber Sale Contracts

As an aid to people who are unfamiliar with timber sale agreements, a sample contract is given here. It shows the more important provisions that should be included in a contract for the sale of marked trees to be scaled in the log. Substitute clauses are given for use in other kinds of sales. No single form of contract will suit all classes of sales, but owners of woodland timber should have no difficulty in adapting this contract to their use.

SAMPLE TIMBER SALE CONTRACT

Agreement entered into on this.....day of....., between.....of....., hereinafter called the seller, and.....of.....hereinafter called the purchaser.

Witnesseth:

ARTICLE I. The seller agrees to sell the purchaser, upon the terms and conditions hereinafter stated, all the living timber marked or designated by the seller and all the

merchantable dead timber, standing or down, estimated to be
.....board feet, more or less, on Lot.....Con.....
in the Township of.....County of.....
and located on a farm owned by the seller and about
miles from.....

ARTICLE II. The purchaser agrees to pay the seller the
sum of.....more or less, as may be determined by
the actual scale, at the rate of.....per thousand
feet.....
.....
.....
payable prior to the date of removal of material, in instal-
ments of.....each.

ARTICLE III. The purchaser further agrees to cut and
remove said timber in strict accordance with the following
conditions:

1. Unless an extension of time is granted, all timber
shall be cut, paid for, and removed on or before.....
.....

2. Saw timber shall be scaled by the.....
log rule, and measured at the.....
.....

3. The maximum scaling lengths of logs shall be 16 feet;
greater lengths shall be scaled as two or more logs. Upon
all logs an additional length of 4 inches shall be allowed
for trimming. Logs overrunning this allowance shall be scaled
not to exceed the next foot in length.

4. No unmarked timber of any kind shall be cut, except
.....

5. Stumps shall be cut so as to cause the least pos-
sible waste - stumps of trees up to 16 inches in diameter,
not higher than 12 inches above the ground, and those of trees
above this size at a distance above the ground not greater
than three-fourths of their diameter.

6. All trees shall be utilized in their tops to the
lowest possible diameter, for commercially saleable material.

7. Young trees shall be protected against unnecessary injury; only dead trees and less valuable kinds may be used for construction purposes in connection with lumbering operations.

8. Care shall be exercised at all times by the purchaser and his employees against starting and spreading of fire.

ARTICLE IV, It is mutually understood and agreed by and between the parties heretofore mentioned as follows:

1. All timber included in this agreement shall remain the property of the seller until paid for in full.

2. In case of dispute over the terms of this contract, final decision shall rest with a reputable person to be mutually agreed upon by parties to this contract, and in case of further disagreement, with an arbitration board of three persons, one to be selected by each party to this contract, and a third to be the Zone Forester or his chosen representative.

In witness whereof the parties hereto have hereunto set their hands and seal this.....day of.....
19.....

Witnesses:

.....
.....

The following are sample clauses that should be substituted in the contract when other methods of sale are used. In lump-sum sales substitute in Article I a descriptive clause modelled on this one:

All merchantable living trees, except.....
.....which
measure 12 inches or less in diameter at breast height (a
height of $4\frac{1}{2}$ feet above the ground).

Such provision will reserve the basis of a second crop consisting of the more valuable and rapid-growing kinds of trees and remove all the inferior and slower-growing trees.

The payment clause in lump-sum sales should be varied to read somewhat like this:

The sum of.....dollars for said timber, payable prior to the cutting of the material, in instalments of.....dollars each, payable on or before respectively.

4. Attempts at a Solution of the Marketing Problem

Orderly marketing of woodland products is to the advantage of the woodlot owner, the sawmill operator and the ultimate industrial consumer who requires definite quantities of certain species in certain grades to carry on his manufacturing business. It has already been remarked that the farmer feels at a disadvantage in marketing logs, and his real or imagined grievances are a detriment to good relations between the buyer and seller of logs and a steady flow of logs to the market. The following attempts at improved marketing may suggest methods which could be applied in the Otter Creek Watershed.

(a) A Marketing Experiment near Doon

During the winter season of 1948 and 1949 the Department of Lands and Forests in the Galt Zone carried out an experiment in the marking and marketing of timber in an 18-acre woodlot near Doon. The project was initiated by Mr. I. C. Marritt, the District Forester, and the field work was done by Mr. L. S. Hamilton, Zone Forester. The scheme is patterned after a marketing assistance method meeting good success in the State of New Jersey.

The mixed uneven-aged woodlot contained considerable large white pine and red oak. Initial investigations by the Department showed growth stagnation due to overstocking and recommended the removal of certain trees representing the accumulation of growth over a number of years. Under this condition, removal of selected trees reduces the growth

stagnation factor, and the remaining trees grow at an increased rate. As growth again slows down, another cropping should take place. This is the simple principle of selective logging - the removal of accumulated growth periodically to keep the stand at a healthy, productive growth rate.

Upon explanation of the proposed marketing assistance, the woodlot owner entered into a signed agreement with the Department as a co-operator, agreeing not to sell or allow to be cut any trees except those marked, upon penalty of a nominal fine per thousand for the estimating and marking service of the Department.

The trees were marked with a view to a second marking which would be necessary afterwards to remove weed trees and trees of low value in order to give good growing conditions. Each tree marked for removal was blazed at breast height and below stump height, the stump blaze being branded to detect any unauthorized cutting. The total log scale estimated for the 223 trees marked was 47,600 board feet, Doyle Rule. The trees were listed as to species and diameter on a mimeographed form.

All the estimation data were turned over to a timber agent chosen by the Department. The timber agent entered into written agreement with the owner to

- (1) solicit tenders from buyers;
- (2) draw up a timber sale contract protecting the owner;
- (3) check on cutting operations; and
- (4) measure and collect payment for all wood cut before its removal from the property.

The agent was to receive a percentage commission of the gross sale value.

The timber agent mailed the volume estimate sheets to all local log buyers, giving location of the woodlot and inviting inspection of the bush.

The timber sale contract set forth the prices agreed upon for the different species, required that tops be

worked into 4-foot wood to be paid for at an agreed price per standard cord, provided penalties for the cutting of unmarked trees and required that the woods operation be conducted with a minimum of damage to the woodlot.

Prices realized by the owner were much better than the average paid in the area. Prices per thousand board feet, Doyle Rule, for the standing timber were:

White and red oak.....	\$62
White ash, soft maple, hard maple, basswood and cherry.....	\$60
White pine.....	\$55
Hemlock.....	\$45
Beech.....	\$30
Fuelwood.....	\$4 per standard cord

The experiment was considered very successful by all the parties concerned, yielding about 2,000 board feet more than estimated, and the woodlot has been left in fine growing condition with an expected second cut in 15 or 20 years of 25,000 board feet.

(b) The Lanark County Co-operative

This co-operative was set up by a group of woodland owners in the County of Lanark in March, 1950. Its objectives are the better management of privately owned woodland to ensure a continuous yield of the best material possible from the forested land of the members through profitable marketing of all the woodland products.

To put the woodland enterprise on a paying basis to the individual, it is necessary to market not only the material suitable for lumber manufacture and special products such as veneer but also the inferior products such as the poorer hardwood species, low-grade hardwood logs of the better species, small softwood products such as cedar posts and poles and that material removed in improving a woodlot during what may be called sanitation cutting. It was felt that the advantages of co-operative action by woodland owners in the field of marketing would best solve the problems of the

individual, particularly in respect to inferior or small products. Acting as a group rather than individually and through a member active in contacting prospective buyers, they can hope for recognition by the buyers in the area as a stable source of the various woodland products.

The establishment of the co-operative followed an extensive educational campaign carried on by fieldmen of the Federation of Agriculture, the Department of Lands and Forests and the local Farm Forum leader. Interest was aroused through moving pictures, talks at schools, local evening meetings, press releases, radio programs and public speaking competitions on woodlot management. Meetings held at Lanark were attended by officers of the Department of Lands and Forests; representatives of pulp and paper companies, sawmills and other wood-using industries; and members of agricultural organizations. Gradually a workable plan was evolved, and the Lanark Forest Co-operative was set up under a number of directors, with Mr. Herb Paul as manager.

Mr. Paul, of Lavant, the main force behind the formation of the co-operative, is an energetic leader of the local Farm Forum, caretaker of the Lanark County Forest, a farmer, and owner of several hundred acres of woodland in Lavant Township. As manager of the co-operative his duties entail the location of markets for the woodland products of the members, arriving at satisfactory price schedules, collection of payment for products, ensuring that products are ready or delivered at the time promised and advising members on cutting their woodland according to best forestry practices.

In the fall of 1950 membership in the co-operative was approximately 60, with an increasing interest in its operations prevalent. By September, 1955, it had grown to 150 members, with total holdings of 35,000 acres in Lanark and Frontenac Counties. The membership fee is \$5, and in addition the co-operative takes 5 per cent of the sale proceeds

of products handled. The member pledges himself to supply the quantity of material at the time and place agreed and is urged to practise woodlot management according to conservation principles.

At present the co-operative has no intention of undertaking a manufacturing endeavour such as a sawmill for lumber or railway ties. Logs are not accumulated at a central point and sorted as to species and a grading standard, but are handled direct from woodland to buyer. The purchaser's measure of the volume, by grade where it might apply, is accepted as the basis for payment on transactions.

An objective of the co-operative, stated as the better management of privately owned woodland to ensure a continuous yield of the best material possible, is a highly commendable aim. However, the statement entails a tremendous amount of field work on the part of those capable of advising on the subject of woodlot management. This is a job requiring experienced field personnel. At present, although the Department of Lands and Forests is following this development in marketing with interest and co-operation, it has not the staff of extension foresters to provide the many owners of farm woodland with the guidance that is necessary. If the farm woodlot is to assume its place in the economics of the farming enterprise, it must be shown that it pays in dollars and cents to the owner. The average woodlot owner cannot afford to carry on practices at a financial loss in the interest of the region or posterity. If, in its infancy, the co-operative manages to make money for its members by the sale of those products generally difficult to market as well as those relatively easy to market and does the best it can toward field guidance on woodlot management for perpetual yield, then it will have done a lot toward good forestry in its area.

CHAPTER 4

FOREST CONSERVATION MEASURES IN PROGRESS

1. Private Planting

The soil of a considerable portion of the Otter Creek Watershed is of a light, sandy nature, ideally suited to reforestation purposes. Similar conditions extending to the east led to the establishment of the Provincial Forest Station at St. Williams in 1908. As a result the value of windbreaks and forest plantations was gradually realized. With the development of tobacco growing much of the light soil was no longer available for trees and in some cases former plantations have been cleared. However, private tree planting has continued on lands unsuited to tobacco and a total of 1,584 acres is now established on the watershed. The portion of this area established by various dates is shown below.

Present Plantations Established by	Area (Acres)
1915	2
1925	21
1935	368
1945	969
1955	1,584

Private individuals and municipalities may obtain advice and assistance in reforestation and woodlot management through the Department of Lands and Forests' Zone Foresters at Aylmer for Elgin and Norfolk Counties, at Stratford for Oxford County and at Hespeler for Brant County. The Zone Forester also assists in the establishment of Authority forests, county forests, demonstration and school plots.

Survival and growth of seedlings have been good, but recent insect damage has caused some concern. About one-third of the older plantations have been thinned and a



Pruning of Christmas trees produces good form and attracts the buyer who puts a premium on quality



This fine young pine plantation shows clearly how neglected corners of the farm may be returned to profitable timber production.

similar area pruned. The remainder would benefit from similar treatment. In a few cases cattle have been allowed to damage the plantation, and in several others fire has caused some damage.

About half of the recent plantings are devoted entirely to Christmas trees. Only a small minority of these growers are pruning or otherwise caring for their plantations to produce top quality trees.

2. Authority Forests

Twelve Conservation Authorities have now entered into agreements with the Ontario Government for the establishment and management of Authority forests. The Province advances half the cost of the land and, in some cases, where it is necessary or desirable to include merchantable timber as in the Backus purchase on Big Creek, the Province also assumes the cost of the merchantable timber. These agreements run for a period of 50 years, during which time the Ontario Government agrees to establish the forest and pay the cost of such items as fencing, buildings, equipment, labour, maintenance, trees, etc. - in short, everything connected with the management of the forest.

At the end of the 50-year period the Authority may exercise any one of three options: First, to take the forest over from the Government and pay back the cost of establishment and maintenance without interest; second, to relinquish all claim to the forest, whereupon the Government will pay to the Authority the balance of the land cost without interest; third, the forest may be carried on as a joint undertaking by the Province and the Authority, each sharing half of the cost and half of the profits. Authority lands are subject to municipal taxes.

A primary consideration in choosing areas for Authority forests is the protection of the headwaters of streams. The Otter Creek Conservation Authority had, by the

time of the survey, already decided to implement such a program. Options were, therefore, taken on $162\frac{1}{2}$ acres in Burford Township and 50 acres in North Norwich, mainly hardwood swamp supplying the headwaters of two streams, and these areas constitute the nucleus of the Otter Creek Conservation Authority Forest.

3. County Forests

Many counties have established forests under agreements which differ only slightly from those described for the Conservation Authorities. The counties pay the full cost of the land and are not required to pay municipal taxes.

The only county plantation within the watershed is the Zenda Tract of the Oxford County Forest.

The Zenda Tract, which contains 105 acres, was acquired by the County in three parcels, from 1939 to 1955. Nearly half of the tract is natural woodland and much of the open area has been planted, but restoration of forest conditions on some of the more difficult scrub covered sections remains to be completed.

4. Demonstration Woodlots

The most important measure which could be taken for forest conservation would be the improved management of present woodlots. An early effort in this direction was the establishment by the Department of Lands and Forests of demonstration woodlots. These are areas of private woodland on which the owners have agreed to follow prescribed methods of woodlot management and to permit access to the area by interested persons.

Eight demonstration woodlots were established in the Otter Creek Watershed.

Well conducted demonstrations could exert an influence for proper management in the surrounding area. Unfortunately, some of these demonstration woodlots have been

cut over when the property changed hands, and others have been neglected so that they no longer serve their original purpose.

5. Tree Farms

In the past few years a movement has been under way to recognize well-managed forest properties as Certified Tree Farms. With the sponsorship of several organizations interested in better forestry, the Canadian Forestry Association in 1953 formed a National Tree Farm Committee to recognize with a suitable sign and certificate those owners who agree to maintain their land for growing forest crops, protect the land adequately, agree that cutting practices will be satisfactory to ensure future forest crops, and permit inspection by Committee foresters. Two Tree Farms have already been certified on the Otter Creek Watershed.

Several Conservation Authorities have become co-sponsors of the Tree Farm movement in their areas, and it is recommended that the Otter Creek Conservation Authority give its support to this movement.

6. Tree-Cutting By-Laws

Under The Trees Conservation Act of 1946 and its successor The Trees Act (R.S.O. 1950, c. 399) twenty-one counties have passed by-laws to restrict and regulate the cutting of trees. These by-laws do not interfere with the right of the owner to cut material for his own domestic use, but specify certain diameters below which trees may not be cut for sale.

The limits provided by the counties covering the Otter Watershed are given below:

County	Height to Measure Above Ground	Minimum Diameter Which May be Cut In Inches				
		5	6	8	12	14
Brant	18"	Cedar				Others
Elgin	16"	Cedar, Black Locust				Others
Norfolk	18"		Cedar, Birch, Cherry, Locust, Poplar	Tamarack, Jack & Scotch Pine		Others
Oxford	4½'	Cedar	Poplar	Tamarack	Others	

In general these limits are too low, and greater uniformity between counties would be desirable. The fact that considerable clearing has taken place in the past five years on the adjoining Big Creek Watershed indicates the difficulty in enforcing such laws. Presumably experience on Otter Creek has been similar, although detailed information is not available. Nevertheless, in spite of some failures, wherever a vigorous attempt has been made to enforce these by-laws rigidly they have proved of considerable benefit.

Such diameter limits are only an elementary step to prevent indiscriminate slashing of woodlands. There will, however, usually be fast-growing trees above the diameter limit which are increasing rapidly in value, and should be left for future cutting. There will also be poorly formed or diseased trees below the diameter limit which should be removed.

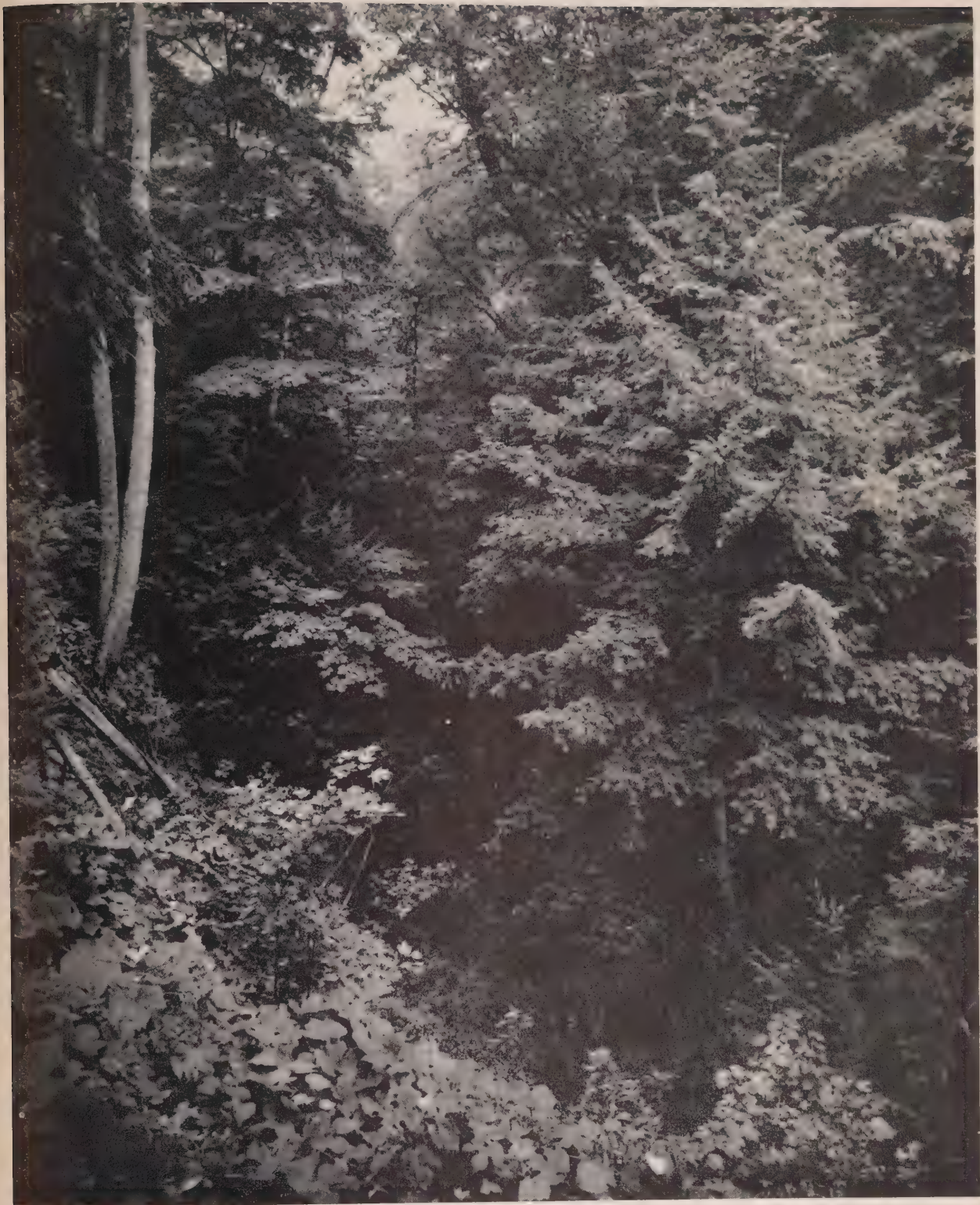
Better than a rigid diameter limit is the marking of trees for cutting according to their condition. Professional advice on such marking is available through the Zone Forester. Many tree cutting by-laws provide for the necessary variations from a strict diameter limit where the cutting is done under such supervision and in accordance with good forestry practice.

7. 4-H Clubs

These clubs are organized by the Ontario Department of Agriculture assisted by the Department of Lands and Forests and must be sponsored by an organization interested in the improvement of woodland and reforestation.

Members must be between 12 and 21 years of age and each member undertakes a project such as marking a half-acre of woodland for thinning or reforesting a quarter-acre of land. Projects are judged annually on Achievement Day and prizes awarded; for this purpose the Department of Agriculture furnishes \$3.00 per member and the sponsoring organization \$1.50. Winners may enter the Provincial Inter-Forestry Club Competition.

At present none of these clubs are operating on the Otter Creek Watershed. Sponsorship of such clubs would be a worthwhile project for the Authority.



The steep slopes of this ravine are well protected by the maintenance of forest cover.

CHAPTER 5

SOME FOREST CONSERVATION MEASURES REQUIRED

The activities through which the Authority may further forest conservation fall into three broad categories. In woodlot improvement demonstrations or private planting the Authority may co-operate with private landowners. In larger areas needing reforestation or management the Authority may acquire land and manage it directly. Through public meetings, field days and publications the Authority may educate and encourage residents of the Otter Watershed to practise conservation on their own lands.

1. Woodlot Improvement Projects

For most persons the best lesson in conservation is field observation of specific examples of the present abuses and efforts to remedy them. Woodlots chosen as illustrations must be near good roads and should be marked with large signs giving considerable detail of conditions and improvement measures in progress. Roadside or other parking facilities would have to be provided so that visitors could take the full time necessary for inspection without interfering with other traffic.

Some of the proposed improvements are experimental in nature. From the owner's point of view the whole program may seem to be of unproved value. On these sample areas the Conservation Authority is therefore fully justified in assuming part of the actual woodlot improvement cost as well as the cost of signs and parking facilities.

To use a private woodlot in this way for educational purposes would require a definite agreement with the owner to ensure that the proposed improvements were carried out, and that the benefits of this work would not be lost by a change of ownership or of attitude on the owner's part. In addition a detailed record of costs and returns would be

necessary to show other owners that it would pay for them to adopt similar practices in their own woodlots.

Some owners may be willing to see their woodlots used for such demonstrations, but wish to be relieved of any personal participation in the project. In such cases the Authority might lease the woodlot or purchase it outright.

Below are listed several examples of well-located woodlots suitable for Authority woodlot improvement projects. The Conservation Authority should decide on suitable forms of agreements, leases, etc., explain the purpose of these projects to the owners and try to enlist them as co-operators. This list is by no means exhaustive, but serves to illustrate the type of woodlot suitable for such projects.

- (1) Lot 24, Con. III, Windham Township
5 miles east of Otterville

Beech - hard maple, with some other hardwoods and white pine. Needs some spreading beech and hickory cut to release better young maple and pine.

- (2) Lot 14, Con. V, N. Norwich Township
3 miles west of Norwich

Beech - hard maple type, with some trees of merchantable size, densely stocked. Needs removal of some hickory, beech and poor quality maple to maintain vigorous growth of better trees.

- (3) Lot 7, Con. X, Dereham Township
1 mile north of Tillsonburg

Beech - hard maple, with some white pine. Some poor quality material has been removed as fuel and this should continue. Assistance with fencing might be needed to prevent grazing.

- (4) Lot 17, Con. VII, Dereham Township
2 miles south-west of Dereham Centre

Beech - hard maple, with some merchantable trees. Needs fencing and removal of poorer beech and other trees.

- (5) Lot 10, Con. IX, Bayham Township
5 miles west of Tillsonburg

Hard maple type, densely stocked young stand. Needs fencing and removal of spreading maples and crooked beech to improve growth.

- (6) Lot 136, Con. NTR, Bayham Township
5 miles east of Straffordville

A mixed white pine type, containing some oak and maple. Needs removal of spreading beech and defective pine and poplar, but in places is sparsely stocked and needs either planting or preparation of the ground to encourage natural regeneration. Production of high quality logs would be speeded by pruning some of the young pines.

- (7) Lot 8, Con. IV NTR, Middleton Township
2 miles south-east of Tillsonburg

Partly a mixed white pine and hardwood type and partly a white oak type, well stocked. Requires removal of spreading beech and defective pine, oak and maple. Particular attention should be given to limbing some of the young pine and releasing it from shade.

- (8) Lot 12, Con. WNR, Houghton Township
 $\frac{1}{2}$ mile south of Kinglake

A densely stocked silver maple - white elm stand, many of the trees having originated as coppice after cutting. These clumps should be thinned down to one stem each, to improve growth and quality.

2. Private Reforestation

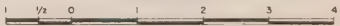
On many farms, even in good farming areas, there are small tracts which, because of steep slopes, poor drainage or severe erosion danger, would be better in tree cover. These tracts are not suitable for public acquisition and management, but the effect of reforestation on control of run-off, improved summer stream flow and stabilization of wood-using industry justifies public assistance in such work. These areas have not been privately reforested heretofore because the owner has some other minor use for the area, because he is discouraged by the long period between planting

RECOMMENDED
AUTHORITY FOREST
AND
WOODLOT IMPROVEMENT
PROJECTS

LEGEND

- RECOMMENDED AUTHORITY FOREST
- WOODLOT IMPROVEMENT PROJECTS

SCALE - MILES



and harvest of a forest crop or more commonly simply because of inertia on his part. The interest of private owners in reforestation may be fostered in several ways. Public education, such as that now carried out by the Zone Forester in the district, can be furthered by the Authority. In addition, direct assistance to private planting can be given. Several other Conservation Authorities have purchased tree-planters which supply a planting service to private owners at a nominal cost. Where rough ground makes hand planting necessary, some Authorities pay a direct cash subsidy if inspection shows that planting has been done carefully and the plantation is adequately protected from livestock.

It is the policy of the Department of Lands and Forests to charge \$14 per thousand for Scotch pine and \$10 per thousand for other planting stock. For some years trees were distributed free. Following the end of the war in 1945, the nurseries were unable to meet the greatly increased demand, and it was felt that a charge for trees would ensure more care in ordering the required amount and in planting the trees received. The assistance schemes carried out by other Authorities have stimulated interest in private reforestation while still ensuring the good use of the planting stock. It is recommended that the Otter Creek Conservation Authority adopt some similar policy of assistance to private reforestation.

3. Otter Authority Forest

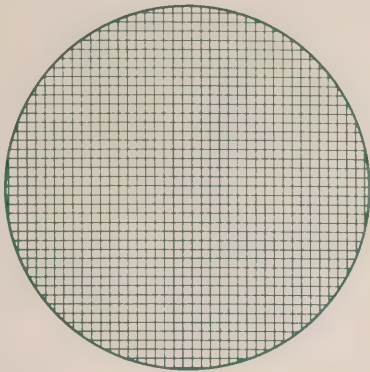
When large areas (100 acres or more) require reforestation or woodland management, the task is frequently too great for private initiative. In such cases acquisition by the Authority is recommended. This is particularly desirable where these forests form natural water-storage areas which decrease the severity of floods and maintain the summer flow of streams.

In all, 4,909 acres are recommended for acquisition by the Otter Creek Conservation Authority. Of this total, 535 acres are open lands, 4,108 acres have some form

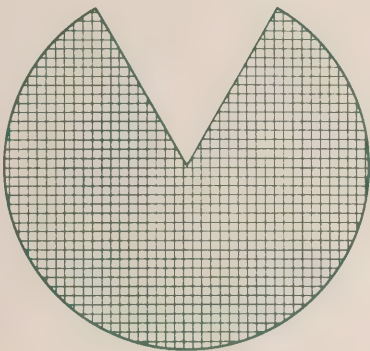
of tree cover and 265 acres are scrub. A minimum of land in the better classes has been recommended for reforestation. However, it was impossible to omit such land entirely when it formed a small part of a lot which was composed mainly of a poorer type of soil. In the few cases where these lands are already being well managed by private owners there is no urgency for public acquisition. Even here, however, the Authority must be alert to see that a change in circumstances does not allow these lands to fall into other hands in which their usefulness for conservation purposes might be destroyed. It is for this reason that these few properties are included in the recommended areas.

The recommended areas are situated mainly near the boundary of the watershed, much of the acreage being head-water swamp of streams feeding Otter Creek and Little Otter Creek. The efficiency of this land in retaining water and so maintaining the stream flow might be seriously impaired by further clearing or unwise drainage schemes. The acquisition of these areas is necessary both to maintain the present forest cover and to reforest the open land which is now largely unproductive.

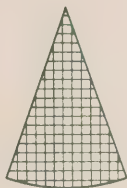
The problem of land acquisition should be approached carefully. In most cases purchase will be arranged by direct negotiation. The Authority should also be alert to acquire tax-delinquent lands. The Authority has the power to expropriate land and is justified in doing so when an unreasonable attitude on the part of the owner stands in the way of works urgently required for the general good. However, a favourable public attitude is essential to the furtherance of conservation and such powers must be used with discretion. Very few of the recommended properties are occupied. In an exceptional case, if a hardship would be entailed by asking an old resident to move, some special provision such as a life tenancy of the house might be arranged.



TOTAL AREA
OF
RECOMMENDED AUTHORITY FOREST
4,909 Acres
(100 %)



WOODLAND
4,108 Acres
(83.7 %)



REFORESTATION LAND
535 Acres
(10.9 %)



SCRUBLAND
265 Acres
(5.4 %)

LAND CLASSIFICATION
RECOMMENDED AUTHORITY FOREST

Land prices paid by different Conservation Authorities and even within the individual Authority have varied greatly. Properties already purchased by the Authority in the recommended areas and those purchased by the adjoining Big Creek Region Conservation Authority have varied from \$13 to \$45 per acre.

4. Forest Research

Detailed scientific research is the task of universities or government departments with greater research facilities than are available to a Conservation Authority. Large-scale application of proven methods is the task of private owners or of the Department of Lands and Forests in managing Authority Forests. Between these two extremes, however, there are many possibilities for small-scale investigations which are urgently needed and which the Authority might encourage on its own land or on private land under agreement. Determination of the best planting methods on difficult sites such as valley slopes, comparison of growth in different plantation mixtures, investigation of the value and cost of cultivation in plantations and the actual improvement in woodlots following thinnings or other treatment are all projects which would guide the people of the watershed in managing their own plantations and woodlots. The Authority should encourage such investigations and co-operate with the Department of Lands and Forests in carrying them out.

5. The Authority and Conservation Education

Many agencies at present do, or can, engage in conservation education. The Authority can supply opportunities and materials to encourage and enlarge these activities. Wall maps, literature, conservation pictures and conservation lectures supplied to the schools will help to give geography, history and conservation practices a local significance. Building up a library of slides on local conservation problems and accomplishments would be of great assistance to speakers.

Organization of public meetings and contact with individuals and groups such as farm forums will gain support for both private and public conservation efforts. Landowners should be encouraged to make greater use of the services available from the Conservation Authority and from officers of the Department of Lands and Forests and the Department of Agriculture.

The most effective educational activity is actual participation in or field observation of conservation projects. Tree planting days, group visits to woodlot improvement projects and conducted tours over a well organized conservation trail could all be sponsored by the Conservation Authority. These activities would all stimulate individual action in forest conservation measures, such as those described in the following chapter, which cannot be carried out directly by the Authority.

CHAPTER 6

FURTHER CONSERVATION MEASURES REQUIRED

1. Woodland Management

The woodlot inventory shows that there are 30,638 acres of woodland on the Otter Creek Watershed. Practically all of this area requires better management, While experimentation is desirable to determine the best method of handling certain problems, the general principles of woodlot management have been known for years but have not been applied. A free advisory service is available from the Zone Foresters, but is not sufficiently used, and a readily understood pamphlet on "The Farm Woodlot" can be obtained from the Department of Lands and Forests.

One of the most difficult problems confronting the private owner in the management of his woodland is the utilization of the small woodland products which can be readily made and handled by the owner. These products such as fuelwood, pulpwood, bolts, posts and poles, if properly harvested, increase the productivity of the woodlot and the gross returns per acre. The volume of these small products has been reduced by diameter limit regulations which have restricted the wholesale commercial slashing of woodlots. Nevertheless, much material of this type could still be produced from thinnings and improvement cuttings and from limbs and tops of trees. The difficulty of marketing such low-grade material has seriously hampered owners in carrying out the needed improvement work in their woodlots. Any means which can be discovered for using small and poor-grade wood should be developed to the fullest extent. At the present time interest is increasing in the possibility of manufacturing wood chips in the woodlot by means of a portable chipper. Such chips can be used for the manufacture of pulp for paper, and as cattle bedding and chicken litter, which can subsequently be spread on fields to increase the humus content of





Removal of poor trees for fuelwood has improved the woodlot on this Tree Farm. The marked trees are being used to study growth rates in this stand.



Indiscriminate slashing has destroyed the timber-producing capacity and greatly reduced the effectiveness of this swamp for water storage.

the soil. They can be made from any species of wood, and tops and branches can be utilized. The number of pulp companies which can use hardwoods is limited at the present time and only those making kraft paper can use chips containing bark, but the demand for hardwood chips will increase and portable barkers are being developed. Every woodlot owner should consider the possibility of improving the quality of his woodlot by utilizing the low-grade material as chips or otherwise.

Owners of large woodlots might be encouraged to undertake thinnings and improvement cuttings if equipment or trained crews were available at reasonable cost. The Authority should consider offering such a service. As an alternative, the Authority might offer a subsidy for each acre improved to its specifications and found satisfactory on inspection by the Authority's officers.

2. Elimination of Woodland Grazing

The Report of the Ontario Royal Commission on Forestry, 1947, contains the following statement:

"The most widespread abuse of forests is that of utilizing them as pasturage for animals. If this practice alone could be eliminated more than half the battle to save Ontario woodlots would be won. Forestry and pasturage cannot succeed on the same piece of ground, as diametrically opposite conditions are necessary for each.

"It is foolish to consider replanting millions of acres to forests unless the owners of millions of acres already under forest are convinced of the necessity and economy of caring for them in such a manner that they will be perpetuated and improved."

This abuse is less widespread on the Otter than in some sections of Ontario simply because many farms devoted to tobacco growing do not carry any livestock. Where cattle are kept, grazing of woodlots is common. There are a number of reasons for the widespread practice of allowing woodland grazing. The woodlot has always been considered a pasture field even though the value of woodland pasture is low compared to cleared land. The reason for its low carrying capacity is partly because grass grown in the shade is not

nearly as high in food value as that grown in full sunlight. The following statement in respect to woodland pasture has been made by leaders in agriculture: "On the whole, the opinion of the Agronomists is that, on the average, woodland pasture will produce about one-sixth the quantity of pasturage, and the quality will be about one-half as good as that of the improved pasture". Weeds are usually prolific in wooded pastures, often smothering most of the grass.

If shade is required for stock, it may be desirable to leave a portion of the woodlot in the pasture when fencing the woodlot. Another solution is to establish small groves of fast-growing hardwoods which can be fenced temporarily until the trees are sufficiently tall that browsing will not damage crown growth. Where springs or streams that supply water for the stock are situated in the woodlot access may be made to a trough near the spring and the area should be fenced to prevent trampling.

A fully timbered maple stand, 60 years old, may yield about 4,000 board feet of saw timber per acre. Such a woodlot is virtually ruined by 20 years of heavy grazing, whereas 20 years of protection and no logging may increase the net volume to approximately 8,500 board feet per acre. The gain of 4,500 board feet is equivalent to an annual increase of 225 board feet per acre. At \$28 per thousand on the stump this amounts to a mean annual gross income of \$6.30 per acre over the period of utilizing only the increase in volume.

Livestock admitted to woodland browse on the leaves and shoots of small trees and ride them down, and by scuffing the surface roots of larger trees injure them and permit entry of fungus diseases.

Field observations indicate that cattle have preference habits in grazing woodlands. Unfortunately this preference is for the more economically desirable species such

as maple, basswood, elm and beech, whereas undesirable species such as hornbeam, blue beech, dogwood and hawthorn are grazed only when cattle are seriously underfed. This combination of factors, under continued grazing, changes not only the quantity but the quality of the reproduction and so the succeeding stand. The poorer hardwood species, and conifers where these occur, are favoured. The invasion of pastures by cedar and hawthorn is an illustration of this grazing preference.

Livestock grazing affects more than the growth of trees on the owner's land. Soil erosion in the woodland increases as the absorptive capacity and mechanical protection afforded the soil by the litter is reduced. The open canopy exposes the soil to the erosive force of rain impact and a compacted soil forces overland movement of water. Livestock tend to follow trails in the woodland and these often become centres of serious erosion. Thus continued grazing increases surface run-off and soil erosion.

Obviously continued woodland grazing is more than the private affair of the property owner. Anything which contributes to soil loss and to increased surface run-off lowers the yield capacity of the land on the one hand and adds to the flood hazard on the other. The lessened value of wood products reaching the market and the increased cost per cow on poor pasture are economic losses to the community as well as to the individual. The Authority is therefore justified, not only in carrying out a vigorous campaign of education in woodland improvement, but also in offering direct assistance to woodlot owners. The County of Halton has already adopted a program of assistance for fencing of woodlots, although to date this program has not had a very marked success. It is recommended that the Otter Creek Conservation Authority through discussions with woodlot owners should formulate some modification of this program which will stimulate action toward the elimination of woodland grazing and the improvement of private woodlands.

In spite of the studies and publicity to date, the seriousness of the grazing problem has not yet been brought home to the person most concerned, the farm woodlot owner. It is recommended as a step in this direction that the Authority publish a simple, attractive bulletin on woodlot grazing.

3. Forest Fire Protection

In spite of the publicity given to the damage caused by fire the average person does not realize how serious this is. Though he may know that young growth and small trees are burned by surface fires he does not realize the extent of the less obvious damage such as the destruction of humus which itself preserves the condition and water-retaining capacity of the soil. When the humus and ground cover are destroyed the sun and dry winds remove the moisture required for tree growth and plant nutrients are destroyed. The heat of the fire also injures the growing tissue inside the bark of older trees which are not actually burned, exposing the wood to attack by insects and fungi. Even though through time the wounds may be completely healed, the damage shows up as defects when the tree is cut for lumber.

The first step in fire control is fire prevention, and the best assurance of prevention is an enlightened public opinion which will make every member of the rural community conscious of the seriousness of the fire damage and of his duty as a citizen to do all he can to prevent it. The farmer can prevent most fires in farm woodlots if he exercises the same care that he does around his home and buildings. It is particularly necessary to exercise such care in areas which have been cut recently, since the accumulation of slash creates a serious fire hazard. Close utilization of tops and the scattering of slash so that it lies close to the moist ground and rots faster will help to reduce this danger.

From the evidence collected in the northern states of the United States, where conditions most nearly

approximate those of rural Southern Ontario, it is apparent that the most effective fire protective systems are those set up under the following conditions:

- (a) Where the system is organized under the direction and control of the state forester and the wardens in each township are appointed by him on the recommendation of the local council.
- (b) Where wardens paid an annual retainer are actual residents in the locality. Usually they are farmers who have had practical instruction in fighting fire. They have the power to call out other local residents to help in fire-fighting and maintain a store of fire-fighting tools on their premises.
- (c) Where the warden is assisted in his work by all members of the community. That is, his address and telephone number are known to everyone and fires are reported to him immediately.
- (d) Where designated members of the community know that they are likely to be called on to fight fire and are paid so much per hour for the time they are so employed.
- (e) Where every resident is thoroughly fire-conscious and realizes that loss of timber by fire is a loss to the whole community, and considers it his duty to prevent, report and fight fire.
- (f) Where fires for burning brush and rubbish may be set only after a permit has been obtained from the local firewarden.

It is therefore recommended that the Authority set up a committee to determine the best method of providing fire protection for public and private lands, through the co-operation of the Department of Lands and Forests, for the protection of woodlands in the Otter Creek Watershed.

4. Protection from Insects and Diseases

In projects such as the public and private reforestation recommended for the Otter Creek Watershed, careful consideration should be given to the prevention of outbreaks of insects or tree diseases and adequate arrangements made for the immediate application of control measures when these become necessary. While it is not possible to predict accurately the course insects or disease may take under the ever-changing conditions of a newly forested area, there are a number of fundamental principles which, if applied, will greatly lessen their destructiveness.

Large areas of one kind of tree present ideal conditions for an outbreak of insects or fungus disease. Mixing species in the plantation or separating the species in small blocks tends to slow the spread of outbreaks until natural agencies bring them under control or direct control measures can be applied.

It is important to plant only the species of trees suitable to the site and existing growing conditions. Healthy, vigorous trees are certainly more resistant to attack than weak, struggling ones.

Over-mature and dead trees should be removed from the existing stands as these harbour bark-beetles and wood-boring insects which may become excessively abundant and attack healthy, adjacent trees. Fungus infections may likewise spread from such sources.

Care should be exercised to prevent ground fire. Even light ground fires are frequently followed by severe outbreaks of bark-beetles and wood-boring insects and fungus infection at the base of the trees.

Woodcutting operations, sawmill sites and wood storage yards should be carefully supervised or they may become reservoirs of infestation.

It is essential that an inspection be made each year so that any abnormal increase in insects or disease may be noted and control measures initiated before the outbreak becomes serious. Prompt action may reduce control measures to a comparatively easy task and confine damage to a small area.

(a) Some Important Insect Pests

The White Pine Weevil has caused serious damage to plantations by attacking the leading shoots of young white pine. As this insect prefers to work in full sunshine, white pine should be grown in mixture with some other species which will shade the pine in its early years.

In recent years the European Pine Shoot Moth has increased to epidemic proportions in red and Scotch pines. Investigations are under way but no simple and effective control measures have yet been discovered. Another enemy of these species, the Root-collar Weevil, has recently been reported near Angus in Simcoe County. This insect kills young trees by girdling them below the ground. In the U.S.A., where this insect is better known, certain emulsions applied around the base of infested trees are said to give good control.

Leaf-feeding insects may kill conifers by one complete defoliation and hardwoods by defoliation for three years in succession. However, even partial defoliation may so weaken trees that they will be attacked by other enemies. Protection from leaf-feeding insects is therefore desirable. This is the kind of attack against which spraying is most successful.

Since investigations of forest insects are constantly under way, the owner considering insect control should always check with the Zone Forester to find the most effective methods now in use.

(b) Tree Diseases

The chief diseases of the hardwoods are the various trunk, butt and root rots, and chronic stem cankers,

which are all endemic and may cause serious damage under aggravating conditions. Woodlots on the Otter Creek Watershed present very diverse conditions with respect to the incidence of these diseases, a circumstance which is usually related to their past history. Thus many containing old timber are in need of heavy preliminary salvage and sanitation cuttings as a result of mismanagement or neglect. Such cuttings should precede or be combined with cleanings and improvement cuttings, designed to improve the composition and structure of the stands. Having established a sanitary condition, normal care should maintain it and obviate loss on account of decay.

The wood rots are commonly thought of as diseases of mature and over-mature timber, but experience has shown that infection may occur at a very early age. In hardwood sprouts the stem may be infected from the parent stump. In older trees infection is chiefly through wounds, either of the root or trunk, which may be caused by fire, trampling by animals, insects, meteorological agencies, or by carelessness or accident in felling and other woods operations.

For many reasons "cleanings" in the reproduction are desirable, especially where the woods have been heavily cut. Besides favouring the valuable species, those stems which are of seedling origin should be favoured over stump sprouts which are more liable to decay.

In harvest cuttings, which should recur at frequent intervals, the permissible volume allotted should include trees in which incipient decay is discovered and so far as possible those which have become a poor risk through injury or other circumstances.

The white pine blister rust is a serious enemy of that important species. It can be controlled by elimination of the currant and gooseberry bushes which spread the disease. This is economically feasible where white pine is growing on



Erosion on bare slopes threatens the adjoining land. Tree cover could stop erosion and restore the area to productivity.



Windbreaks protect the crop and add beauty to the farm.

good sites, and where a considerable concentration of white pine on a small area reduces the labour involved.

5. Windbreaks and Shelterbelts

In the process of clearing land for agriculture woodlots and belts of trees along fence lines have been removed which had served as natural shelterbelts. The restoration of these in the form of windbreaks is essential to a complete conservation program in many parts of Southern Ontario.

When proper species are used and windbreaks are correctly placed the effects are almost entirely beneficial. The effects may be direct or indirect, but in either case are the result of reduction in wind velocity. The effects of windbreaks on crops and cultivated fields may be listed as follows:

(a) Direct Effects

- (1) Wind damage and lodging in small grains and corn is reduced or eliminated.
- (2) Snow and the resultant moisture are more evenly distributed over fields, particularly on the higher spots where they are required most.
- (3) Wind erosion of the soil is minimized.

(b) Indirect Effects

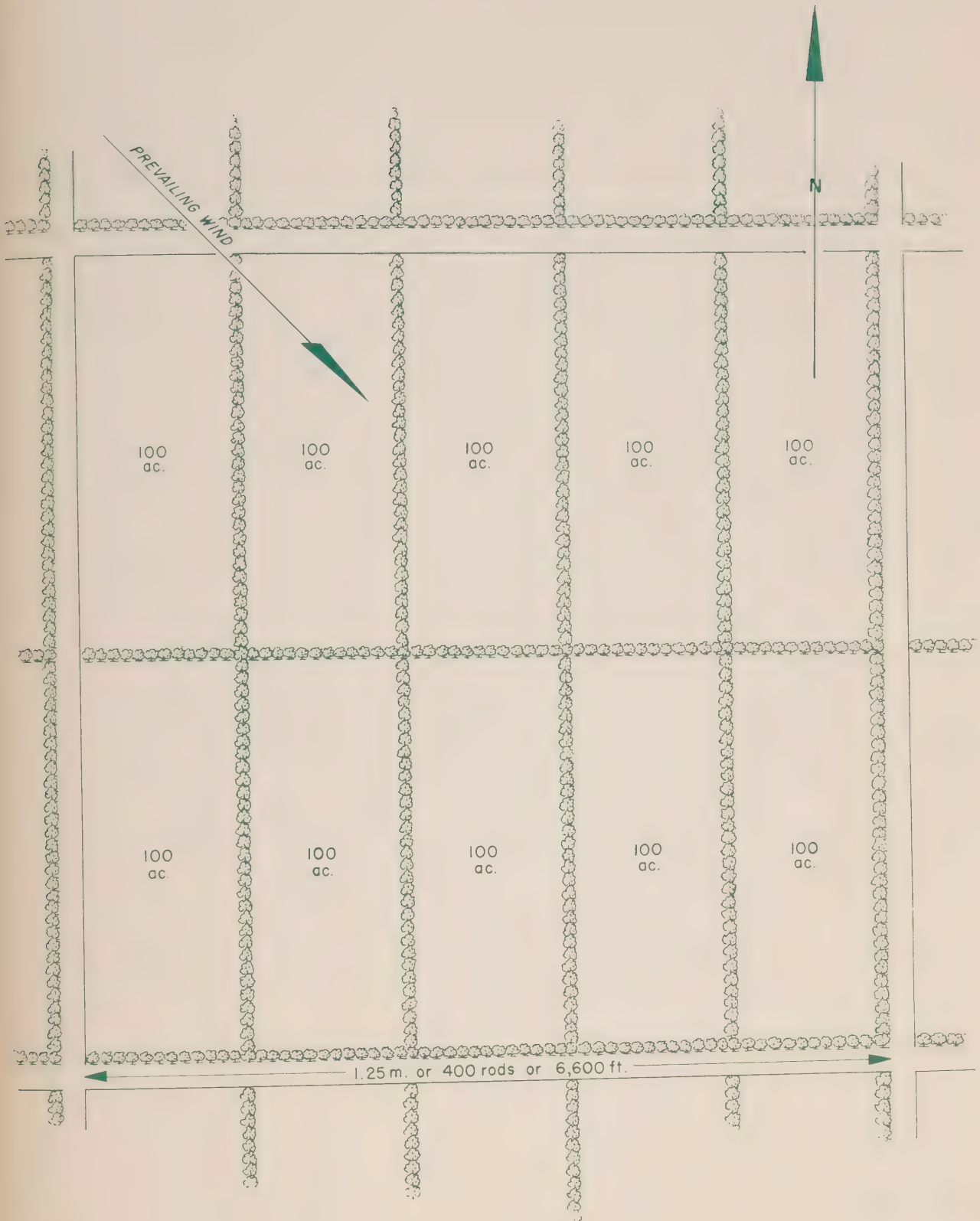
- (1) Moisture loss by evaporation is reduced.
- (2) Temperatures in the fields are raised, which may prevent frost damage, accelerate growth and even lengthen the growing season slightly.
- (3) Erosion of the soil by water may be reduced by its more even distribution when released from snow.

The benefits of windbreaks to buildings in reducing heat loss in winter have been shown to be considerable. Experiments conducted in the United States proved that more than twice as much heat is lost from a house, per day or per hour, with a wind of 20 m.p.h. as with one of 5 m.p.h., and a windbreak can easily reduce wind velocities in this proportion

WINDBREAK PLAN

for

1,000 ACRE BLOCK



This plan shows the minimum windbreak requirements for a 1,000 acre block on level land. Woodlots and plantations will replace some of this and placement will have to be adjusted according to topography and soil on rolling land.

Used in this way they can often be made to form an effective background for the house and a protection for farm buildings. Another advantage of windbreaks is that they provide shelter and runways for insectivorous birds and small animals.

Belts of trees comprising one or two rows are usually called windbreaks, and with more than two rows, shelter belts. In Southern Ontario windbreaks as a rule give sufficient protection except where wind erosion of soil on rolling land is severe, when shelterbelts may be required. On level land windbreaks may nearly always be established along existing fence lines, but on rolling land consideration should be given to the contour of the land. The prevailing winds in Southern Ontario are generally from the west, so that the greatest protection will be derived from windbreaks on the west side, but the placement of windbreaks on the other three sides as well should be considered.

Both the height of the trees and the wind velocity influence the effective range of a windbreak. An average windbreak will reduce the ground velocity of a 20-mile wind 10 per cent or more for a distance of about 30 times the height of the trees. About one-fourth of this effect will be felt on the windward side of the windbreak and three-fourths on the leeward side. For example, if the trees are 40 feet high the total effective range with a 20-mile wind will be 30×40 or 1,200 feet, 300 feet of which will be on the windward side and 900 feet on the leeward side. Generally speaking, the reduction in velocity is greatest close to the windbreak and tapers out to zero farther away. With higher wind velocities and/or higher trees the proportionate reduction and the effective range will be greater.

European alder is gaining great popularity as a windbreak tree because it is a nitrogen-fixer like the legumes and does not rob the soil to the same extent as non-nitrogen-fixing species.

One consideration that should be kept in mind is that under certain circumstances windbreaks may cause air stagnation, which may increase temperature and moisture conditions to a dangerous degree in summer or increase frost damage in spring and fall on small areas, particularly in hollows. Where this is likely to occur, windbreaks should be planted so as to guide the flow of air past such spots. Where these conditions develop after the windbreaks are established they may be relieved by judicious opening up of the windbreaks.

Experience has shown that windbreaks are an asset to any farm, that their adverse effects, if any, are local and easily remedied, and that in many areas they are essential to the control of soil erosion by wind. It is therefore recommended that the Authority encourage the establishment of windbreaks by private owners in every way.

WATER

CHAPTER 1

GENERAL DESCRIPTION OF THE WATERSHEDS

1. Boundaries and Dimensions

The Otter Creek Conservation Authority is composed of the drainage area of (Big) Otter Creek and its tributaries and the adjoining drainage area of Little Otter Creek, both of which empty into Lake Erie at Port Burwell (but at different points).

These drainage areas have an irregular outline, roughly rectangular and are bounded by the following watersheds: on the west by Silver Creek and other small creeks which drain into Lake Erie, Catfish Creek and the South Branch of the Thames River; on the north by Big Creek; on the east by Big Creek and its tributary Venison Creek, Clear Creek and another small creek, all of which empty into Lake Erie; and on the south by Lake Erie with a shoreline of $4\frac{1}{2}$ miles.

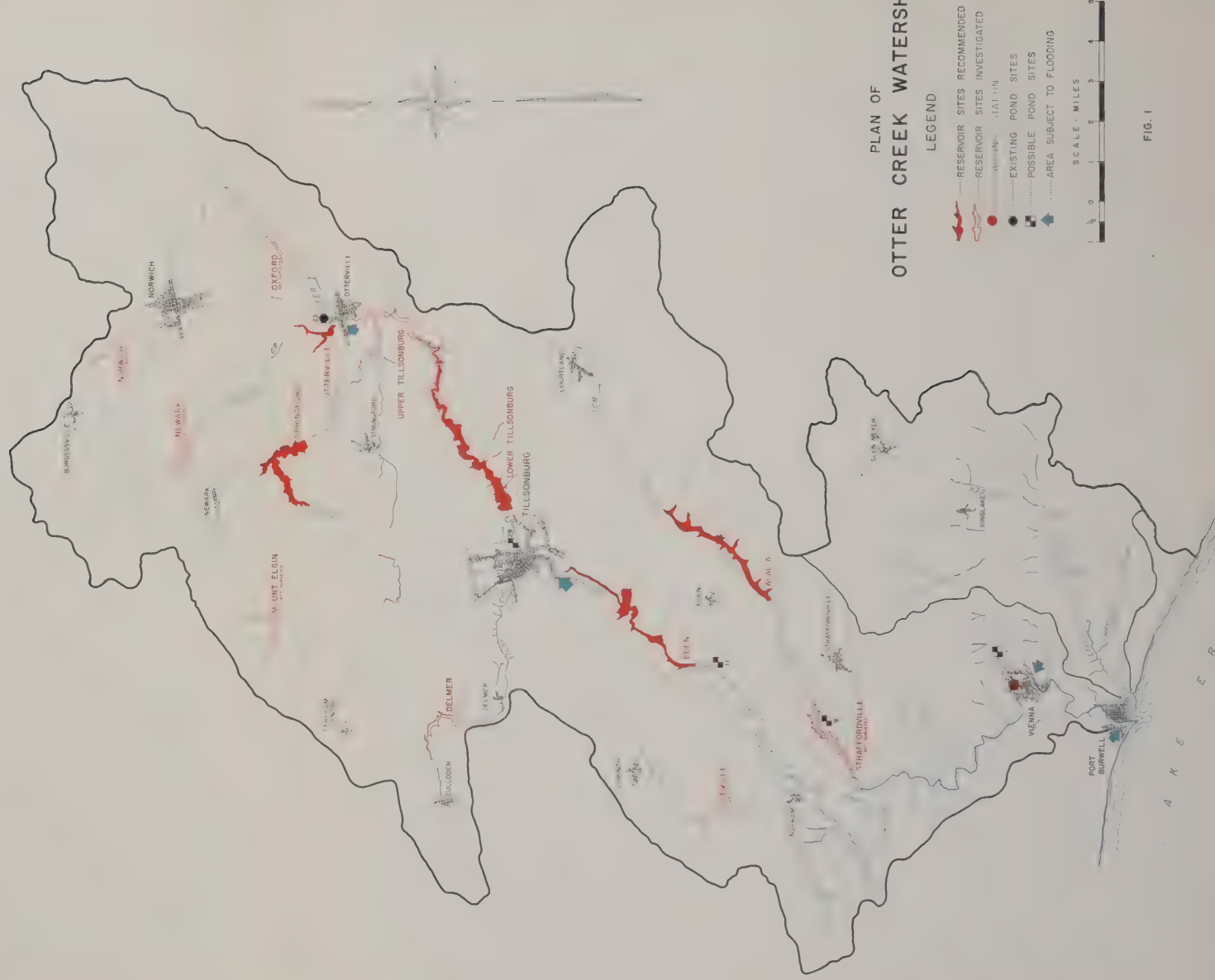
Its length north from the lake is about 29 miles and its average width about 11 miles. The drainage area of (Big) Otter Creek and its tributaries is 272.80 square miles and of Little Otter 43.17 square miles, or a total of 315.97 square miles for the Authority.

Plan of the watersheds is shown in Figure 1.

2. Municipalities

The municipalities within the (Big) Otter Creek and Little Otter Creek Watersheds are: part of Burford Township in the County of Brant; parts of Oxford East, Norwich North, Norwich South and Dereham Townships in the County of Oxford; parts of Windham, Middleton, Walsingham and Houghton Townships in the County of Norfolk and parts of Malahide and Bayham Townships in the County of Elgin.

A small segment of Dorchester South Township in the County of Middlesex also comes within the (Big) Otter Creek Watershed.



Other incorporated municipalities are; the town of Tillsonburg and the villages of Norwich, Vienna and Port Burwell.

The area is well serviced with many miles of township and county roads and provincial highways. A railway line from Tillsonburg to Port Burwell services the lower part of the area, while above Tillsonburg the area is crossed by several lines which fan out from Tillsonburg to Ingersoll, Woodstock and Brantford. In addition to these north-south lines the area is traversed by two east-west lines in the vicinity of Tillsonburg.

The total population of the area as of 1956 was 21,546.

3. Terrain

Except for the river valleys the topography of the area varies in general, from fairly level with good drainage to undulating. The streams are youthful in appearance having deep V-shaped valleys with little or no flood plain. Below Tillsonburg the valleys vary up to 100 feet or more in depth and approximately one half mile in width. These narrow valleys provide many good damsites but they are not ideal for low cost storage.

Table 1 shows the various soil types and the percentage of each in the area. It may be seen that the soils are predominantly sand and till plain. The wooded area, including plantations, amounts to about 16 per cent of the total area.

4. Rivers and Main Tributaries

The (Big) Otter Creek rises about 3 miles west of the village of Burgessville (Fig.1). Its course in general, is south-easterly through and 4 miles beyond the village of Norwich, where it swings south-westerly through the town of Tillsonburg and continues in that general direction to its

TABLE 1

OTTER CREEK WATERSHED
PERMEABILITY OF SOIL TYPES

Soil Type	Per Cent of Watershed
<u>Pervious</u>	
Spillways	4.5
Muck	1.4
Shorelines	1.3
Sand Plains	39.4
Sub total	<u>46.6</u>
<u>Semi-Pervious</u>	
Drumlins	0.1
Complex of Clays, Till and Eroded Materials	6.4
Till Moraine	26.6
Sub total	<u>33.1</u>
<u>Almost Impervious</u>	
Clay Plain	2.8
Undrumlinized Till Plain	17.5
Sub total	<u>20.3</u>
Totals	100.0 100.0

confluence with the East Branch, thence in a general south-easterly direction through the village of Vienna to Port Burwell where it empties into Lake Erie. The creek has a total length of about 54 miles and a fall of about 440 feet. The stream gradients vary from 3.7 feet per mile in the lower reaches to as high as 67.5 feet per mile in the headwaters with an overall average gradient of 8.2 feet per mile.

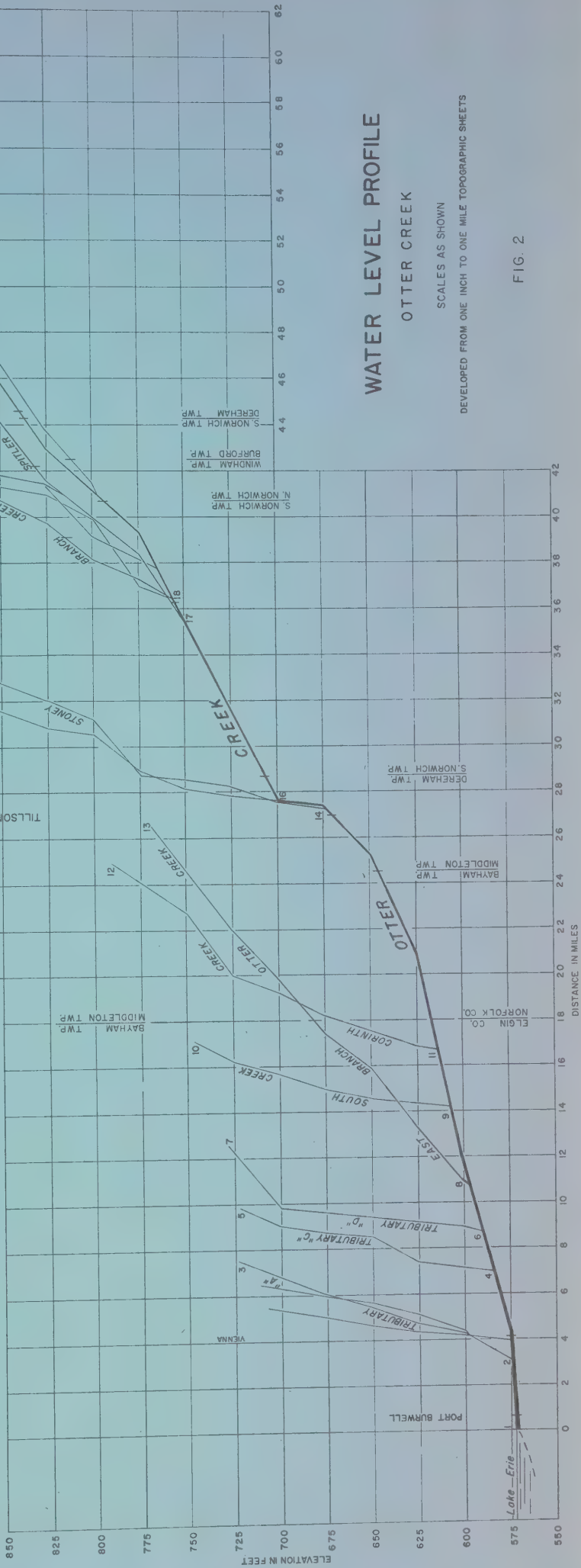
The principal tributaries of the (Big) Otter Creek and their points of confluence relative to Tillsonburg are: Stony Creek at Tillsonburg; the East Branch 17 miles downstream (from here to its mouth it is known as Big Otter Creek) and Spitler Creek about 8 miles upstream. The water level profiles of the main river and its tributaries are shown on Fig. 2, which includes a table showing elevations and gradients for each stream. Small unnamed creeks have been designated by letters. Drainage areas of the tributaries and other data are shown in Table 2.

The Little Otter Creek drainage system has several headwater streams of equal size and importance which rise in the height of land between the drainage areas of the (Big) Otter Creek on the west or north-west and the Big Creek on the north-east and east sides.

The main branch rises north-east of Glen Meyer at an elevation of 755 feet and flows in a general south-westerly direction to its outlet into Lake Erie about $\frac{1}{2}$ mile east of Port Burwell. The overall drop from the headwaters to Lake Erie is 183 feet for an average gradient of 16.5 feet per mile. Gradients of the other main headwater tributaries average about 30 feet per mile.

Hemlock Creek is a tributary in the lower part of the area joining the main stream 1.5 miles upstream from the mouth.

GRADIENT TABLE							
RIVER	FROM POINT TO POINT		DISTANCE IN MILES	ELEVATION OF POINTS		DIFFERENCE OF ELEVATION	GRADIENT FEET PER MILE
OTTER CR.	1	14	27.2	572	673	101	37
OTTER CR.	14	16	0.4	673	700	27	67.5
OTTER CR.	16	20	2.8	700	900	200	8.8
OTTER CR.	20	21	3.3	900	1012	112	33.9
OTTER CR.	1	21	5.3	572	1012	440	82
TRIBUTARY "A"	2	3	4.4	575	723	148	33.6
TRIBUTARY "C"	4	5	2.9	584	722	138	47.6
TRIBUTARY "D"	6	7	3.9	590	729	139	35.6
EAST BRANCH	8	13	15.8	597	769	172	10.9
SOUTH CR.	9	10	2.9	607	747	140	48.3
CORINTH CR.	11	12	8.2	614	791	177	21.6
STONEY CR.	14	15	9.8	673	921	248	25.3
SPITLER CR.	17	22	17.3	752	905	153	8.8
BRANCH CR.	18	19	6.9	757	899	142	20.6



WATER LEVEL PROFILE

OTTER CREEK

SCALES AS SHOWN
 DEVELOPED FROM ONE INCH TO ONE MILE TOPOGRAPHIC SHEETS

FIG. 2

TABLE 2
OTTER CREEK WATERSHED - DRAINAGE AREAS IN SQUARE MILES

Tributaries	Places		Damsites		Gauge
Main Otter	133.7	Port Burwell	271.8	Acacia	36.3
East Branch	47.7	Vienna	262.0	Eden	167.4
Stony Creek	17.7	Tillsonburg (Stony Cr. only)	17.7	Tillsonburg (Lower)	126.5
Branch Creek	10.2	Tillsonburg (at No.3 Hwy. crossing)	134.4	Tillsonburg (Upper)	119.7
Spitler Creek	46.4	Norwich	18.2	Delmer	8.8
Corinth Creek	17.2	Otterville (at confluence)	54.7	Otterville	9.8
		Otterville (Branch Cr. only)	10.2	Springford (Upper)	32.6
Total Drainage Area of Otter Creek			272.80		
" " " Little Otter Creek			43.17		
Total Area of Authority			315.97		

CHAPTER 2

FORMER FLOODS

The periodic swelling of the streams and rivers at times of heavy run-off was on the whole an advantage to the first inhabitants of Upper Canada. The flooding of the river flats enriched the Indian cornfields and made them easier to clear and to cultivate. High water made travel much easier on many canoe routes and opened others which were impossible except when certain low lands were flooded by a freshet. It was only when circumstances forced them to travel by land at the time of the spring break-up that the Indians were greatly inconvenienced by ordinary floods. That this inconvenience might be serious is shown by a passage in La Salle's account of his overland journey from the Detroit River to Niagara in April 1680.

"The Indian and one of my men succumbed to the toil of walking continually in water, the constant rain and the great thaw having flooded all the woods."

This misfortune probably took place well to the westward of Otter Creek, but the conditions described, prolonged rain accompanying a thaw, are those that have always produced more or less heavy flooding over a wide area.

When the real settlement of Upper Canada began, about a century after La Salle's journey, the settlers also found the spring freshets useful. On most streams it was only at high water that loaded boats or rafts could be used for any distance from the lakes. This was true even where the normal summer flow was deep enough for boats. The rivers in their natural state were usually obstructed by boulders, logs and tangled masses of debris, with the banks of sand and gravel that eventually formed behind such obstacles. Settlers also valued river flats - "meadows" or "intervalles" - both for pasture and arable. Regular flooding in the early spring interfered very little with this use of the flats and was even beneficial if the flood was not severe enough to sweep away

the topsoil. Flash floods in summer or autumn were another matter. These sometimes surprised the Indians in temporary encampments or destroyed their crops. The European settler usually placed his buildings on higher ground, out of harm's way; but he was even more likely to have his crops spoiled, or swept away just as he was about to bring them to his barn. With the crops went fences and sometimes stock.

As an area was opened to settlement, travel by land increased and interruption of communications is mentioned more often. Surveyors were particularly exposed to this inconvenience. They had to travel in straight lines back and forth across a township and frequently record their difficulties in crossing swollen streams, or the interruption of their work by the flooding of low ground. From these entries and other sources we know of a number of freshets on the streams in this region between 1790 and 1810, some of them severe floods. At this time the Otter Creek area was unsettled and crossed by no important trail. Only one of these references is to a freshet on that river, although Big Creek had flooded in spring in 1796 and 1797, and in autumn in 1797, under conditions that must have produced freshets on the neighbouring streams.

The first direct reference to Otter Creek occurs in the Diary of a survey of Houghton, Bayham, Malahide and Yarmouth Townships, carried out by Mahlon Burwell in May and June, 1809.

"Wednesday, 31st May - Hindered some time crossing Big Otter Creek, had to fall a large Hemlock Tree across it which would have failed us had not the Creek been narrower below that the banks interfered as it swam down."

It is worth noting that this was an early-summer flood, caused by rain only. Burwell had been prevented from starting by heavy rain on the 28th, which continued until the following afternoon. On May 30 he had found Big Creek "very high in consequence of the great fall of Rain". It "rained smartly in the night" of May 30. They had to resort to the same method to

cross Catfish and Kettle Creeks and, as there was more rain on the night of June 1, the creeks probably rose still higher.

The area began to be settled soon after Burwell's survey, but progress was slow until after 1820. Bridges and mills began to be built and flood damage became more costly. There are almost no references to flooding on the streams flowing into Lake Erie until after 1830, although a number of freshets and floods are recorded on the Thames and Grand Rivers. A freshet is mentioned in a late account of George Tillson's arrival at the site of Tillsonburg in 1825. After 1830 references to flooding in this part of Western Ontario are more frequent. Floods are known to have occurred over most of the area in 1832, 1833, 1836, 1837 and 1838. A traveller on the Talbot Road in March 1833 found Otter Creek ten feet deep and twenty yards wide and was told that this was about twice the normal depth in summer. The bridge seems to have been undamaged, but this was apparently not the peak of the freshet. In 1836 a thaw towards the end of February put parts of the road from Vienna to Middleton and Burford under water. The real break-up at the end of March was prolonged into April by heavy rains. Roads were again flooded and bridges carried away. There were other floods in May, June and October, 1836, affecting Kettle Creek, Big Creek and the Lynn River. However, the Reverend Thomas Green, from whose journal these references are taken, did not happen to visit Otter Creek at these times. The flood on Kettle Creek on June 23 was the highest recorded until 1857.

Flood records in Ontario usually become fuller after 1850, for in many areas files of local newspapers are available. This is not the case in this watershed and the Toronto papers have few reports from the area until after 1860. There must have been sizeable freshets on Otter Creek in some of the years that produced severe floods over the whole province - for example in 1843, 1851 and 1857. In 1865 the Tillsonburg Observer reported on March 23:

"The recent thaw has done considerable damage in various places. We are not aware of any damage having been done by the Otter, although the water is higher than it has been for many years - so high, indeed, that Mr. Tillson's Mills could not run on account of the back-water. But in other places it has been different."

From this report it would appear that the Otter Creek area suffered less in the early sixties than some other parts of this region. This cannot be taken as certain, for on March 12, 1868 the Observer reports a more serious flood, but says:

"This section has escaped unusually well, as we have not yet heard of one instance where any harm has been done". It then reports the damage at Vienna in much milder terms than the dispatch from that village printed in the Toronto Globe of Wednesday, March 11, 1868.

"The large quantity of snow melted on Saturday last, caused the Otter Creek to overflow portions of the village on Monday. All along the front streets the water rushed through to a depth of four or five feet. Row boats passed freely up and down the business streets, and families living near the creek had to leave their houses. The lumber, shingles and fences were carried down the stream. Had the ice broken and come down, nothing could have saved part of the village from destruction. The water has been the highest ever known before. The floor of the telegraph and post office was covered with water to the depth of two feet - No other casualties."

The Tillsonburg Observer says that two bridges were also carried away at Vienna and mentions rain on March 6 and 7.

The flood on Otter Creek on January 23, 1874 was thought to be the highest ever known at Otterville. Bullock's dam in the village and N.B. Bowman's dam two miles away were both damaged. There may have been more serious damage downstream that was not reported. This is still more likely to be the case in the great flood of July 10-11, 1883. This was caused by the same thunderstorm that brought about the catastrophe at London, but there had been heavy rains and some flooding in the previous weeks. The only report concerning Otter Creek is found in a dispatch to the Globe, printed on July 12:

"Tillsonburg, July 11. - This morning Tillsonburg and vicinity was visited by the greatest floods ever known in the community. The rain of Tuesday night (10th) had been so heavy that all the mill-dams were taxed to their utmost with the great body of water that was rising, and on Wednesday morning the stream was too great for Hamilton & Sons' dam, and it gave way and about six o'clock washed the new grist mill down into Waterhouse's pond. A few minutes afterwards Waterhouse's dam broke, and for a time it was feared that the woollen mills would be carried off. About half-past six Going's dam succumbed to the pressure and carried off a bridge. Tillson's oat and pea mills were in danger for some time, but they escaped with a slight overflow in the basements The dam at Graves's grist mill on Nettle Creek, adjoining the town, broke also Several farms were flooded and the crops badly damaged. The town reservoir had a narrow escape. The total to the town will be in the neighbourhood of \$25,000."

Another great storm on the night of June 3-4, 1890 caused floods over a large part of Ontario. Otter Creek damaged Going's dam to some extent and the flats near Richmond (Bayham) were deeply flooded. A boy of fourteen was drowned while wading on these flooded flats the day after the flood. Destruction of trees and fences in the vicinity of Tillsonburg is also mentioned. Most of the damage must again have gone unrecorded. Exactly two years later, on the night of June 3, 1892, another thunderstorm produced a more severe flood. Norwich reported loss of much property and stock. Four dams were destroyed near Otterville, the loss estimated at \$5,000, "and nearly all the bridges in the township, south of Norwich are gone". The millers in and around Tillsonburg suffered severely. "All the dams on the Otter above this town were swept away."

It will be noted that many of the floods recorded have been summer or autumn floods. These were unexpected and often did more damage than the spring freshet. Freshets occurred in most springs and were not thought worth noting unless they were very severe. After 1900 the spring freshets are reported more often and more information is available for the lower part of the area. On March 26, 1904 the Otter washed a wooden bridge at Port Burwell into the lake

and stranded two vessels in the harbour on the dock. Vienna was flooded and a new bridge in the neighbourhood washed from its foundations. The Tillson dam on Simcoe Street in Tillsonburg was washed out by what seems to have been a severe flood in March, 1925. A January thaw in 1929 caused a sixteen-foot rise in the Clear Creek at Tillsonburg and brought tons of ice down on the two dams. These gave way on the morning of January 19 and allowed the ice and water to sweep the valley. The plants of the Canadian Milk Products Ltd. and the International Cooperage Company were badly damaged. The water flowed through open boxcars on the railway, washing away cans of milk; flooded Highway No. 3 with four to six feet of water and caused an ice jam on the Otter which brought the swollen stream to about five times its normal width. Warnings were telephoned to Straffordville, Vienna and Port Burwell. There was heavy damage at all these places. At Port Burwell a gang of men worked all night to break the ice-jam. They were able to secure the boats so that only one small craft was damaged. The flats around the village were flooded as far as the canning factory. Damage at Tillsonburg was estimated at \$15,000 - \$20,000. A second ice-jam threatened to form at Port Burwell in March, 1929, but the Department of Marine and Fisheries blasted the ice before the situation became serious.

In February, 1932 the old Tillson dam at Tillsonburg, near the junction of Highways 19 and 3, gave way for the second time. The break took place at 3:00 a.m. and the released water began at once to undermine the highway. Fortunately this was noticed almost at once and the road blocked to traffic. Within two hours more than 300 yards of the pavement had collapsed. Five years later, on February 9, 1937, heavy rains caused Otter Creek to flood Highway No. 3 at the eastern approach to Tillsonburg and were responsible for several washouts on other roads in the vicinity. Two of these

caused motor accidents and traffic was interrupted on Highway No. 19. Farther down the river the damage was more serious. Vienna was flooded; one bridge was washed away and the approaches to the Mill bridge washed out on both sides.

Much more severe was the flood of April 26-27, 1937. The ice had gone out; the snow had melted and the frost is reported to have been out of the ground. Rainfall far above normal had been reported at London from April 21, bringing the total for April to more than three times the normal figure by April 27. On Sunday, April 25 all three creeks at Tillsonburg were in heavy flood. At Lisgar Lake, the waterworks pond, the flood gates were opened on Sunday, but were not sufficient to handle the overflow. From early Monday morning the pumps of the fire protection plant were pumping "about 1340 gallons per minute" into the mains and through three open hydrants on Broadway. The pumps were kept going for nearly 24 hours and on Monday evening a dike of sand-bags was built on the sidewalk of Concession Street. Firemen were on duty most of the night. The water broke through Concession Street at 6 o'clock on Tuesday morning, undermining the roadway and damaging the railway embankment.

Clear Creek had covered the area around the Borden Company's plant with about three feet of water, flooding the boiler room and causing a shut-down on Monday morning. Payne's lumber yard was swept clean and piles of lumber carried onto the highway and far downstream. At the deepest point, under Forge Hill, the water on Highway No. 3 was believed to have reached a depth of about eight feet. In this vicinity a six-ton transport truck was washed bodily from the highway in spite of efforts to save it. On Monday evening the Otterville dam gave way, and at about the same time a break in the Lake Joseph dam at Tillsonburg released the contents of this large pond. The bridge on Simcoe Street, below the dam, was carried away with a foot bridge farther down the valley.

At Vienna the Otter began to overflow on Monday, April 26. By evening it was higher than it had been for many years and it was thought the crest had been reached. However, when the great rush of water came down from the upper river, a little before noon on the 27th, the water rose to a record height that was estimated to be "over twenty-five feet above normal". This was reliably reported to be ten inches higher than any flood "in nearly three-quarters of a century" - probably since 1865, when exceptionally high water was reported at Tillsonburg. All the lower parts of the village were flooded. The village was still nearly isolated on Wednesday; the supply of natural gas was cut off and many families had to leave their flooded houses. Some houses had more than three feet of water in their lower floors by midnight on Tuesday. The water in the Anglican Church is said to have been four feet above the floor. The river dropped about ten feet at Vienna by Wednesday morning and the highways at Tillsonburg were no longer under water, though still blocked by washouts and debris. Details from other parts of the watershed are lacking and no estimates are given for the damage at Tillsonburg. The damage to private property at Vienna was thought to be "at least \$30,000" with about \$3,000 loss to the municipality. The damage to the Mill bridge in February had amounted to \$1,700.

The flood of April, 1937 was possibly the most severe of which we have any record. In the absence of full records it is not possible to say that higher floods had not occurred before 1860. Some more recent floods have approached this one in volume. Since 1900 the number of dams on the river has gradually decreased and destroyed bridges have been replaced by stronger ones. These types of flood damage are less frequently reported, but, at Tillsonburg at any rate, heavy damage has sometimes occurred in the last twenty years. In February, 1938 there was again four feet of water on Highway

No. 3 at Tillsonburg and fifty employees of the Borden Company were called out at 1:00 a.m. on the 7th to break an ice jam at the bridge east of the plant. Some families in Vienna had to leave their houses, so that the river must have been unusually high in that village.

Conditions very similar to these were reported from Tillsonburg in April, 1947. There was four and a half feet of water on Highway No. 3 on the 6th. This time the Borden plant was flooded and employees had to be evacuated. Both highways (No. 3 and No. 19) were flooded on February 19, 1948, but the water was not deep and there seems to have been little other damage. On April 4, 1950 the flood surrounded the Borden plant, but flooding in the buildings was not serious. There was three feet of water on the highway, enough to block passenger cars but not trucks. There are no reports from Vienna or other parts of the watershed in these years. The floods may have been heavier than the reports from Tillsonburg would indicate, for 1947 and 1948 were bad flood years in Western Ontario.

The most severe flood since 1937 would appear to have been that of February, 1954. Flooding began after twenty-four hours of rain on February 15-16. Most of the tributaries in the upper part of the watershed overflowed, and widespread flooding of low areas was reported around Norwich, Otterville and Tillsonburg. Roads and highways were blocked by water or washouts. Traffic in the area was badly disrupted and flooded or washed-out streets were reported in all three places. Some houses were isolated and many basements flooded. A break in the gas lines at Otterville deprived families in that village and in Norwich of fuel for cooking and heating. The loss to the Borden Milk Company by the flooding of the plant was estimated at \$27,000. The municipality of Tillsonburg suffered heavy loss from washouts on several streets. Highway No. 3 was closed to car traffic



(COURTESY TORONTO DAILY STAR)

Highway No. 3 west of Tillsonburg. 1949 spring flood shows Otter Creek 2 feet deep over highway and at least 10 feet above normal.



(COURTESY MR. SELDON, TILLSONBURG)

Borden Plant at Tillsonburg isolated by flood waters. February, 1954



(COURTESY MR. SELDON, TILLSONBURG)

Highway No. 3 west of Tillsonburg, February, 1954. Flood waters on this occasion reached a depth of 5 feet over the highway.

for 24 hours and to trucks for 18 hours. At the peak of the flood on the 16th the water was five feet deep on the highway at low points. Later it was blocked by a serious cave-in of a culvert.

At Vienna the flooding was increased by an ice-jam between the village and Port Burwell which backed up the water. The water did not reach the highway in the village, but the county road leading north was closed on the 17th. Parts of the village were flooded and houses isolated, but on the whole the flood does not seem to have been so severe as in 1937. Another ice-jam at Port Burwell threatened the bridge, but broke before it became necessary to use dynamite.

This area fortunately escaped the worst effects of the hurricane of October 15, 1954. The storm was sufficient to bring the Otter to "spring height" at Otterville and probably in other parts of the watershed. Some flooding may have taken place, but no serious damage or blocking of roads are reported. On March 8, 1956 the river rose some six feet at Tillsonburg and flooded Highway No. 3 sufficiently to halt light traffic. Clear Creek surrounded the Borden plant and washed out the spur line leading to it.

The material collected would appear to indicate that, though the spring freshet on Otter Creek often produces heavy flooding, a really severe flood in winter or early spring is rather exceptional. On the other hand, it is evident that unusually heavy or prolonged rains may, under certain conditions, produce a flood at any time of year, without any assistance from melting snow or ice. Some of these floods have been the most severe on record. The flood of April, 1937 was of this character, although it occurred during the spring months. In this flood the depth of water over Highway No. 3 at Tillsonburg was by far the highest on record. The statement that at Vienna the water was slightly higher than at any time since before 1867, rests on private

records which have not been traced, but which appear to be reliable. Without this, it might appear that the water had been as high or higher in 1868.

Human memory seems to be short where floods are concerned. The frequent statement that a flood is "the highest ever" cannot be accepted without some kind of checking. On the available records it can be concluded that Otter Creek has produced at least one really severe flood in most periods of ten years, and that these are as likely to be produced by prolonged rain or sudden storms as by the spring break-up. Not all the cyclonic storms that have caused damage in Ontario are recorded to have brought floods in this area. In several cases a very slight change of direction would have brought the centre of the storm over Otter Creek. Flash floods of this kind are not likely to grow fewer. They have caused catastrophe in Ontario in the last five years. These sudden storms, occurring with little warning at any season, are the most striking flood threat at the present time, but the damage caused by the spring thaws cannot be ignored. Neither type of flood can be prevented, but reasonable measures of control can greatly reduce the risk and damage that inevitably accompanies them.

CHAPTER 3

HYDROLOGY

HYDROLOGY encompasses the behaviour of water as it occurs in the atmosphere, on the surface of the ground, and underground. The movement of water from the atmosphere to the ground and back again to the atmosphere is called the "hydrologic cycle". There are many factors which influence the water movement, and particularly that portion between the incidence of precipitation over land areas and the subsequent discharge through stream channels or direct return to the atmosphere by evaporation and transpiration.

The drainage area of Otter Creek is subject to the constant phases of the hydrologic cycle and like other areas, problems exist which are peculiar to the prevailing climatic conditions and the physical characteristics of the area.

1. Precipitation, Stream Flow and Run-Off

(a) Precipitation

The word "precipitation" as used in Meteorology includes all moisture that reaches the earth, whatever its form - rain, snow, sleet, hail, dew or frost. The most significant of these are rain and snow. Through the Lake Erie-Niagara Peninsula region, the average annual precipitation is 33.7 inches, determined from meteorological stations with records of observation ranging from 21 to 45 years.

The Otter Creek area is in approximately the centre of this region and from stations within and in close proximity to the area, with periods of observations ranging from 18 to 20 years, the annual precipitation varied from a low of 26.6 inches in 1941 to a high of 45.1 inches in 1945 with an annual average precipitation of 34.3 inches for the period of records.

Precipitation, of course, is the most significant since it is the source of all stream flow. In many

areas there are sufficient reliable data available for generalized estimates of this factor, but on the whole, additional self-recording precipitation stations are required for a more accurate evaluation of the precipitation - run-off relationship.

(b) Stream flow, or run-off, consists of surface flow and ground water which is constantly entering the stream channel along its course and is broadly the excess of precipitation over evapotranspiration and deep seepage. Surface flow is that portion of rainfall, melted snow and/or ice which reaches the stream channels directly by flowing over the ground surface.

Ground water flow (percolation) is going on continuously and is responsible for maintaining the flow in streams, during periods of drought. This portion is usually classified as base flow.

Measurements of stream flow on Otter Creek have been taken daily since 1948. The gauging station is located near Vienna and has a drainage area of 263.0 square miles.

Table 3 shows the maximum and minimum mean daily and mean monthly flows at this point for the period, and Fig. 3 shows a continuous hydrograph for the period.

As indicated before, the factors affecting run-off are numerous and varied and appear in so many combinations, that it is difficult to classify them in any order relative to their direct effect on run-off. If quantitative results only are required, the best means available is to measure the run-off directly by the use of hydrometric gauges at strategic locations. Here again the use of self-recording instruments is desirable.

Stream flow, or run-off, is the resultant of all the watershed characteristics, and while it indicates the combined effect of the various features on the precipitation that falls on an area, it does not indicate the effect of any one factor.

Measuring and timing surface flow, or direct run-off, are of great concern, since accurate data concerning them make possible a more accurate solution of the particular problems of flood control and water supply.

2. Maximum Flows

(a) Spring Freshets

Where structures such as dams are concerned, it is not the ordinary or average flows that are significant, but the unusual or exceptional ones that may have occurred in the past, or may reasonably be expected to occur in the future. These flows provide the basic design criteria of all major water impounding structures whose failure could result in the loss of life and destruction of property. Therefore it is necessary, in the analysis of the data available, to forecast probable maximum conditions in direct relation to the human and economic factors involved.

By examination of the available hydrometric records of the gauge at Vienna, it is obvious that the maximum flows have occurred most frequently during the late winter and early spring months. The maximum mean daily recorded flow is 4,230 c.f.s*, which occurred in February 1954. This is a mean daily flow and it is probable that the actual peak was in excess of this. On two occasions during the spring freshets, observations were taken at the peak stage and the following table shows the relationship between the mean daily and the actual peak flow.

RATIO OF PEAK TO MEAN FLOW

Date	Mean c.f.s.	Peak c.f.s.	Ratio $\frac{\text{Peak}}{\text{Mean}}$
March 9, 1950	2990	3210	1.07
April 5, 1950	4120	4540	1.10
Average			1.085

* c.f.s. = cubic feet per second

Applying the average of the ratios to the February, 1954, mean daily flow of 4,230 c.f.s. results in a peak flow of 4,600 c.f.s. Flows of approximately equal magnitude were recorded for March, 1948 and April, 1950 and the hydrographs for these periods are shown in Figure 4.

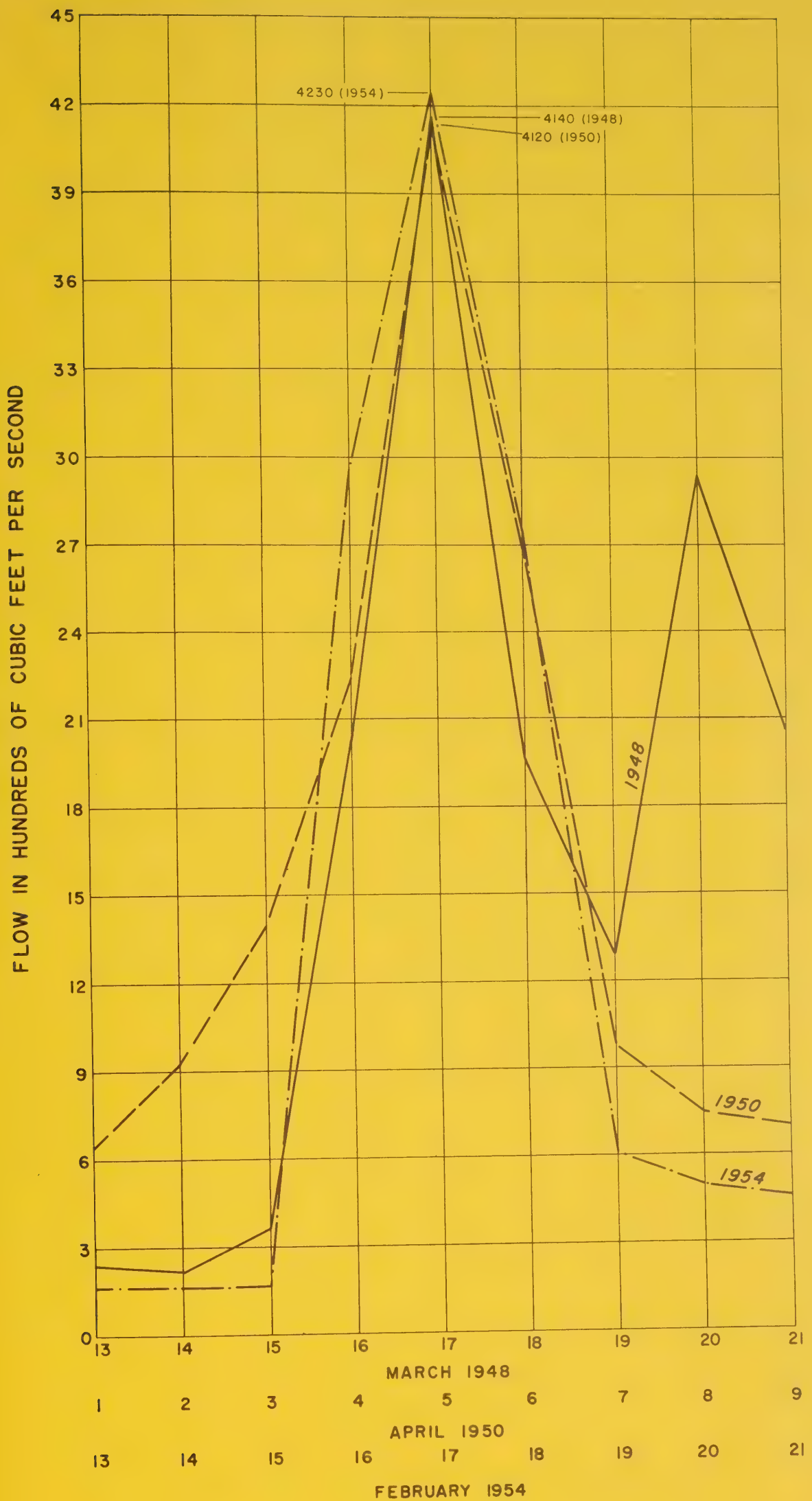
There are references in newspapers and diaries and eye-witness accounts of flooding and flood damage in other years before systematic records were kept, but the available data, if any, are not sufficient to determine the quantity of flow at these times. However, these accounts cannot be discounted entirely and should be made use of, in considering the development of the area where they have occurred.

(b) Other Than Spring Freshets

In recent years it has become apparent that flood run-off, resulting from rainstorms without the aid of melting snow and ice is more significant, and in many instances of a magnitude in excess of that experienced in the spring freshet period.

The The most obvious example of this is the hurricane storm of October, 1954, which caused such widespread damage and loss of life in Southern Ontario. Since that time a new concept of the rainfall-runoff producing type of storm has been gained, particularly in relation to the seasonal operation of flood control structures such as dams.

This is not to say that the usual spring floods will not continue to cause damage and even loss of life on a recurring basis, as indeed they will if not controlled, but with the contribution of hydrometeorology, the analysis and application of the run-off producing potential of the varying storm types, a more rational approach to the solution of these problems may be achieved. Hydrographs for the three greatest flood flows other than spring flows are shown in Figure 5.



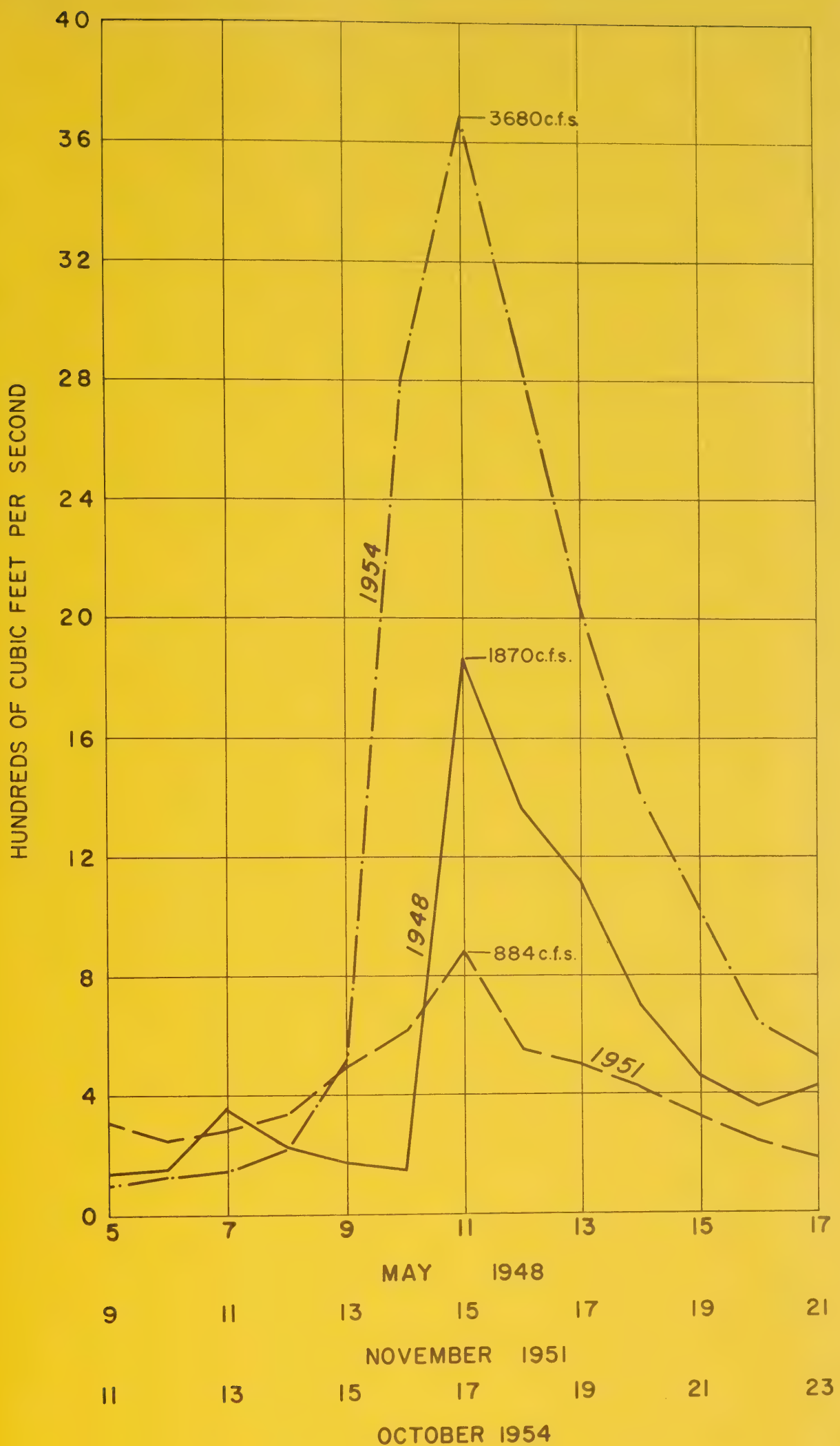
SPRING FLOW HYDROGRAPHS

OTTER CREEK AT VIENNA

DRAINAGE AREA 262.9 SQ. MILES

Means daily flow plotted from records of Water Resources Branch
Dept. Northern Affairs and National Resources, Ottawa.

FIG. 4



SUMMER FLOW HYDROGRAPHS
OTTER CREEK AT VIENNA
 DRAINAGE AREA 262.9 SQ. MILES
 Mean daily flows plotted from records of Water Resources Branch
 Dept. of Northern Affairs and National Resources, Ottawa.

3. Unit Hydrographs*

Where reasonably accurate rainfall and stream flow records are available, the use of the unitgraph method is most adaptable to the problem of design storm flow. The stream flow records for Otter Creek are of short duration and observations are made just once a day, except for two occasions in April, 1950 when observations were made at shorter intervals of one and two hours.

There are no rainfall observation stations within the Otter Creek Watershed, the nearest being at Delhi in the adjacent Big Creek area. However, from the records available an attempt has been made to arrive at a suitable unitgraph that would be representative of the area. To determine the rainfall duration period of storms it was necessary to depend on records of the self-recording gauges at London and St. Thomas.

From the available mean daily flow and rainfall records, unitgraph ordinates were determined for all the available storms that appeared to meet the requirements of this method. The peak ordinates were obtained by applying the peak to mean daily flow ratio as previously determined from the peak flow observations of the March and April, 1950 run-off periods. Table 4 shows the results of the unitgraph determinations.

The peak ordinates from Table 4 were plotted against the rainfall duration to ascertain if a possible correlation existed, from which intermediate unit peak ordinates might be extrapolated. The scatter of the plotted points was not excessive and the resulting unit peaks and rates of discharge are shown below.

* Unit Hydrograph is a graph resulting from a uniform depth of 1 inch of run-off from the total area.

TABLE 4

UNITGRAPH PEAKS FOR UTTER CREEK AT VIENNA FOR SELECTED STORMS
DRAINAGE AREA 263.0 SQUARE MILES

Date	Discharge Max. Mean Daily c.f.s.	Peak Discharge Increased by Ratio - Peak/Mean from Timed Flows	Rainfall Inches	Rainfall Period Hours	Run-off	
					Inches	Per Cent
April 5, 1950	2,900	3,920	1.9	12	1.25	66 *
April 14, 1952	4,480	5,100	1.9	8	0.25	13
May 13, 1956	4,900	5,500	1.60	2	0.35	22
May 7, 1956	3,020	3,520	0.86	9	0.24	28
May 11, 1948	2,750	3,060	2.14	32	0.62	29
Dec. 22, 1949	2,640	2,840	2.13	42	0.64	30
Nov. 20, 1950	1,870	2,080	1.40	-	0.39	28
May 25, 1952	2,320	2,550	1.58	26	0.18	11
Oct. 16, 1954	1,910	2,080	6.12	60	1.73	28

Rainfall figures are from Delhi and Aylmer mainly and with time periods of rainfall from self-recording gauges at London and St. Thomas.

*Run-off percentage appears high and may be due to antecedent soil saturation conditions.

TABLE 4

Duration of Rainfall in Hours	Unit Peak Discharges c.f.s.	Peak Rate of Discharge c.s.m.*
6	4750	18
12	3600	14
18	3170	12
24	2940	11
30	2770	10.5
36	2600	10
42	2470	9
48	2320	9
60	2100	8

It should be noted here that the above table has been compiled from sparse data and should be used only as a guide, until further revision is effected by procurement of more refined data.

4. Design Storms

The "design flood" flow is generally referred to as the hydrograph or peak discharge that is finally adopted as the basis for the design of any particular structure. This flow is dependent on a consideration of the flood characteristics of the particular area and on economic and other pertinent practical considerations.

Usually it is practical to accept a limited degree of risk in the selection of a design flood flow, except for cases where the maximum degree of protection is desirable because of the possible loss of life or excessive damage to valuable property should the structure fail.

The flood damage in the Otter Creek region has not been serious and the extent and occurrences have been outlined in Chapter 2. The actual records show that excessive stream flow usually occurs during the late winter and early spring seasons. However, it is known that a storm such as

* Cubic feet per second per square mile

occurred over Southern Ontario in October 1954, if concentrated over the Otter Creek area could produce a flow far in excess of anything previously recorded for this area.

(a) Hurricane Hazel

This hurricane-type storm which occurred in October 1954, and caused such heavy loss of life, property damage and excessive run-off over a wide area, is considered most significant in relation to potential run-off and project design studies.

The rainfall accompanying this storm was much less on the Otter Creek area than that experienced on the Humber River and adjacent watersheds, located some 90 miles to the north-east, over which the storm centre passed. However, the rainfall covered a wide area and official meteorological stations in the vicinity of the Otter Creek Watershed reported the following amounts.

PRECIPITATION IN THE OTTER CREEK AREA

Station	Date and Amounts in Inches				
	Oct. 14	Oct. 15	Oct. 16	Total 48 hrs.	Total 60 hrs.*
Aylmer	2.44	2.97	1.15	5.41	6.55
Delhi	1.62	3.15	.90	4.77	5.67
Clear Creek	.88	2.83	.27	3.71	3.98
St. Thomas	1.38	1.97	1.77	3.35	4.12
St. Williams	1.08	2.92	.26	4.00	4.26
Simcoe	.95	2.97	.32	3.92	4.24
Waterford	.91	2.97	.25	3.88	4.13
Brantford	1.26	2.68	.53	3.94	4.47
Woodstock	1.36	1.74	.37	3.10	3.47

*Total duration of rainfall was determined as 60 hours.

From the above figures the average rainfall over the Otter Creek area for the 60-hour period was approximately 6.12 inches. The maximum mean daily discharge recorded on the Otter Creek gauge at Vienna was 3,680 c.f.s.

Using the average ratio of peak to mean determined from the timed peak flow records available it is estimated that the peak discharge for this storm was 4,000 c.f.s. By using the Fuller formula ($Q=Q_1(1 + 2A^{-0.3})^*$) to increase mean daily flow to momentary peak, the peak discharge would be 5,000 c.f.s. Therefore it is reasonable to assume that the peak was approximately 4,500 c.f.s.

This flow would be approximately equal to the estimated peak flow for the maximum of record, viz: 4,600 c.f.s. for February, 1954.

The run-off factor determined for the October 1954 storm for the Otter Creek area is 28 per cent.

Though this storm only produced a peak discharge equal to that which was recorded for February 1954, such a storm could have centred on the area with results greatly in excess of any previously experienced in this area.

(b) Hurricane Hazel centred on the Watershed

To estimate the effect of the storm Hazel centred over the area, the total storm isohyetal map was superimposed over the area so as to produce the maximum rainfall quantities in terms of depths in inches on the area.

This isohyetal map was obtained by making use of all the available official records, plus the addition of reliable unofficial observations obtained from areas in between official observation stations.

* Fuller's Formula $Q = Q_1 (1 + 2A^{-0.3})$ where Q = recorded 24 hour average flow in cubic feet per second, Q_1 = corresponding momentary peak flow, A = drainage area in square miles.

The average depth in inches on the area as determined from the superimposed isohyetal map is 8.7 inches. The actual rainfall period during the Hazel storm as it occurred over the area was approximately 60 hours.

One of the most significant factors in the application of the unitgraph technique is the determination of a reasonably accurate run-off coefficient. This depends on a variety of factors and combinations thereof and is most uncertain varying widely with the degree of Perviousness of the watershed area, season of the year, the general climatic conditions, previous precipitation, rainfall intensity, etc.

There are not sufficient basic data available to arrive at a conclusive run-off factor, but from a number of hydrographs of recorded run-off producing rainfalls occurring in the month of October, four (4) were separated with the following results.

RAINFALL AND RUN-OFF FOR SELECTED STORMS
FOR THE MONTH OF OCTOBER

Date	Discharge Max. Mean Daily c.f.s.	Rainfall Inches on Area	Run-Off Inches on Area	Run-Off %
Oct. 1950	232	1.86	0.05	3
Oct. 1951	176	1.23	0.024	2
Oct. 1951	151	1.50	0.06	4
Oct. 1954	3,680	6.12	1.73	28

From the foregoing it can be seen that the run-off factor differs widely due to the wide variation in the volume, intensity and distribution of the rainfall in each case, as well as the antecedent surface and sub-surface condition of the drainage area. Also with the few records available it is difficult to get any correlation or conclusive results.

If the hydrometric and meteorological records were available for a long period of time, it might be possible to arrive at a reasonable increment of run-off in relation to the rainfall volume, intensity and distribution.

Observations over a longer period also present a greater opportunity of including the extreme conditions of the drainage area characteristics, with particular reference to the season of the year.

Since such desirable long-period records are not available and as we are mainly concerned at this point with estimating the peak flow of a design storm of large proportions, the problem becomes a matter of determining a specific run-off factor for this storm.

The maximum run-off for an October rainfall, for the period of record, was determined as 28 per cent. This resulted from a total rainfall of 6.12 inches over a period of 60 hours.

From the available records an attempt was made to develop a unitgraph, from which could be produced some of the known hydrographs, particularly the Hazel flood hydrograph. The resulting unitgraphs covered a wide variety of conditions, seasons, intensities and rainfall distribution but in no case was it possible to reproduce the Hazel hydrograph as it was actually recorded to verify the unitgraph.

This was due in large part to the inadequacy of qualitative data available and the lack of continuously recorded rainfall and stream flow data in this particular area.

However, by applying the results of the unitgraph computations and reducing the Hazel storm to unit proportions it was estimated that a unit peak for a storm of this nature would be 2,700 c.f.s. This was derived by using the Fuller formula to increase the mean daily to momentary peak flow since this gave a somewhat higher figure than the ratio obtained from the two peak flows actually observed.

In view of the run-off factor obtained in the actual storm Hazel on this area, it is assumed that

run-off from the area should a storm of the Hazel magnitude centre over the area, would approach 40 per cent. This increase in the run-off factor over the actual Hazel occurrence is approximately proportionate to the increase in the total rainfall.

The resulting peak flow for the storm Hazel centred on the area would be 9,400 c.f.s., or 36 c.s.m.* at Vienna.

(c) Probable Maximum Storms

From a depth-duration-area analysis of hurricane type storms†, it was determined that a total rainfall of 16.5 inches in 60 hours could occur over the area of the Otter Creek Watershed of 263.0 square miles. Assuming a run-off factor of 60 per cent for this type and duration of storm, the run-off would be 9.9 inches.

Using the unit peak of 2,700 c.f.s. as determined from the Hazel storm, a run-off of this magnitude would produce a peak flow of 26,750 c.f.s. or 102 c.s.m. at Vienna.

In addition to the hurricane-type storms, thunderstorms are often accompanied by intense rainfall and while their duration and extent are generally less than those of the hurricane storms, they often produce higher rates of run-off particularly in areas of 500 square miles or less.

From the data available it was determined that the storm which would likely produce the most critical run-off conditions for an area of this size would be the 6-hour thunderstorm which could precipitate about 12 inches of rain on a drainage area of this size. This probable maximum thunderstorm was derived from 6-hour thunderstorms which have occurred in the United States and which are considered transposable to this area.

* c.s.m. cubic feet per second per square mile

† Preliminary Estimates of Probable Maximum Precipitation over Southern Ontario by J.P. Bruce, Conservation Branch - Department of Planning and Development.

Because of the nature of the soils, the intensity of such a rainfall and of the known run-off values from actual recorded storms of this magnitude, it is assumed that run-off for the probable maximum 6-hour storm would approach 75 per cent.

This factor is in fair agreement with "suggested general values of infiltration" as determined by D.B.Krimgold and O.Beenhouwer,* which indicates a total infiltration loss over the 6-hour period of approximately 2.8 inches or 23 per cent.

With a 75 per cent run-off factor this storm would produce a run-off of 9.15 inches. Applying this to the 6-hour unit peak of 4,750 c.f.s., obtained as described earlier in the discussion of unit hydrographs, results in a peak flow at Vienna of 43,500 c.f.s. or 165 c.s.m.

This probable maximum peak flow of 165 c.s.m. has been used to estimate the spillway capacities of the various damsites in the watershed and is modified only in direct proportion as the rainfall amounts would vary with the size of the areas above the damsites. These figures are shown for each of the damsites considered in a table later in the report.

5. Low Flows

From the available hydrometric records for the gauge at Vienna and shown in Table 3, it can be seen that the periods of low flow occur in July, August and September, and occasionally in October and November.

The minimum flows recorded over the period from 1948 to 1956, occurred in July 1954, when 30 c.f.s. was recorded on the 30th and 31st.

* Estimating infiltration. Krimgold and Beenhouwer, Agricultural Engineering, October 1954.

Over the period of record the average of the minimum monthly flows are lower for August, September and October, with August the lowest, averaging 56 c.f.s. This is equivalent to 0.244 inches depth on area. The minimum daily recorded flow of 30 c.f.s. is equivalent to 0.131 inches depth on area.

These quantities of course, are applicable only to the point of the gauge at Vienna, and it is certain that the contribution is not uniform from the various tributary areas and that many of the smaller streams would be dry during such periods of low flow.

At first glance the above quantities of water seem to be adequate for normal use in an area such as Otter Creek. However, this depends a great deal on distribution, the present water requirements and particularly the future demands of the area in question.

Water Uses

(a) Domestic: As far as can be ascertained all of the area's water supply is taken from wells. There are only a few communities of any size in the area, viz: Tillsonburg, Norwich, Otterville, Vienna and Port Burwell.

Of these Tillsonburg and Norwich operate a water supply distribution system to serve local residential, commercial and industrial users to the extent of approximately 508,880 and 300,000 Imperial gals. per day,* respectively.

Tillsonburg also operates a sewage disposal system which empties into Otter Creek.

(b) Commercial and Industrial

At the present time the demand for water in commercial and industrial plants is relatively negligible. The bulk of the demand is concerned with processing agricultural products such as fruit and vegetables and dairy products.

* 1956 Annual Directory - The Municipal Utilities Magazine.

All of this water, both domestic and commercial-industrial will eventually find its way back to the river, but there is a temporary withdrawal from ground water sources which would, in the case of shallow wells, have an effect on the ground water table in the immediate vicinity of withdrawal.

However, as mentioned above the present combined domestic, commercial and industrial water demands of the area appear relatively small.

(c) Agricultural

The use of water for agricultural purposes is without doubt, of much greater proportions than for any other single purpose in this area. It is quite probable that agricultural use of water may exceed the combined demand for other purposes. This, of course, is significant only in the growing season, when agricultural use of water for irrigation purposes may be necessary.

The present uses of water, namely; domestic, commercial and industrial, and agricultural all tend to contribute to a temporary withdrawal from the ground water sources which, particularly in the growing season from June to September, would have an adverse effect on the river flow.

Although the uses of water for other than agricultural purposes appear to be negligible at the present time, it should be kept in mind that with the rapid industrial expansion and the potential effect of the St. Lawrence Seaway, this area will, no doubt, produce infinitely greater demands than the present available water resources could support adequately. The use of water for agricultural purposes, particularly irrigation of tobacco crops, is increasing and will continue to increase for many years to come.

CHAPTER 4

WATER PROBLEMS

The water problems in this area such as flooding, low flows and pollution are not as serious as on many other watersheds in Southern Ontario. While in most watersheds the flood problem is paramount, in this area the chief problem is the maintenance of adequate summer flow and ground-water storage to meet the expanding irrigation needs and satisfy other water requirements.

1. Irrigation

Water for irrigation is required at a time when ground-water levels and stream flows are low. Large volumes of water are being drawn from the ground-water storage without any apparent ill effect at present, but as this practice becomes more widespread it may well affect domestic wells and result in lower stream flows. Most of the irrigation water is used up through evaporation and transpiration and very little, if any, is returned to the ground water. Also many of those irrigating pump directly from the streams, many of which have been dried up completely for short periods. One can readily imagine the concern felt by others downstream who depend upon the streams for water supply. The effect on fish, wildlife and the potential recreational value of the stream is also deleterious.

Pollution is aggravated by the reduction in the volume of water and with diminishing flows may even reach a point where the water would be unsuitable for any practical use.

From the flow records it is evident that there is not sufficient water during the summer months to permit direct pumping from the streams for irrigation demands and at the same time satisfy the needs of the riparian owners along the stream below.

From these records it may also be noted that stream flows are highest in the late winter and early spring months, when the demand is least. Therefore it would appear that storage reservoirs to conserve a portion of this spring run-off, which normally goes to waste, for use later during the summer months would be the logical solution.

During the high spring flow periods shown in Figure 4 the total volume of run-off or water that was wasted varied from 17,600 acre feet for the April 1950 flood to 30,000 acre feet for the March 1948 flood. These volumes of water, which were discharged in a period of 4 to 5 days in each case, would more than satisfy the present demands and would be sufficient to irrigate all the available tobacco lands in the area.

Preliminary studies,* for the years 1937 to 1956 inclusive, indicate that the moisture deficiency for the period July 1 to August 15 varied from 1.3 to 4.5 inches, with an average deficiency for the period of 3.0 inches. Probability studies show that the moisture deficiency would exceed 3.0 inches approximately 50 per cent of the time and 4.0 inches about 12 per cent of the time. From an economic point of view storage requirements based on a moisture deficiency of 4.0 inches appear logical. This implies that about once in every 8 years water supplies based on this figure will not be adequate for optimum production, but even for this year there would be sufficient to prevent any great loss through drought.

At present there are about 7,000 acres of tobacco grown in this area and for this crop 2,300 acre feet of water storage would be required. In all there are about 47,000 acres of potential tobacco lands, and on this basis irrigation requirements might amount to 15,700 acre feet in

* See Appendix A. Irrigation Water Requirements.

the foreseeable future. These quantities are based on the assumption that the natural rainfall during the irrigation period will offset evaporation and seepage losses.

It is extremely doubtful that if an unlimited amount of water is taken from ground-water storage the other water demands such as domestic use, sustaining the stream flows for fish life, diluting pollution, can be satisfied. Even for irrigation, owing to unequal distribution of the aquifer, some farmers may have plenty and others go short.

Much time is required to determine the available yield from ground water and the ultimate effect of this withdrawal on stream flow. The volume of the aquifer could be determined readily by surveys employing electrical resistivity and seismic techniques, but it would take several years to determine the rate of movement of the water through the ground to its emergence at the watercourses and the time required to recharge the aquifer. This would require daily water level observations of many selected wells, correlated with the records of recording stream gauges and rain gauges installed at strategic points within the area. There are no such gauges in the area at present. Research in this field is necessary and eventually will have to be undertaken. If started now, it would take at least 3 years to determine the yield and distribution that could be expected from ground-water storage.

In the meantime, it will be necessary to pump from wells or dug-out ponds and if, as may be expected, there is not enough ground water for irrigation and other water uses or if, as already stated, the distribution is such that there would be sufficient for some but not enough or none for others, it will then be necessary to build dams with reservoirs which would impound surface spring run-off to satisfy the water demands.

There are approximately 25,800 acre feet of storage available in the recommended reservoir sites which,

providing the sites are acquired and reserved for this purpose, would be sufficient to meet the water demands for many years.

2. Pollution

Neither bacterial tests nor tests of the oxygen content of the water were made during this survey. At the time of the survey pollution could not be considered a major problem in the Otter Creek Watershed as a whole. However, two sections of the river do show serious pollution.

The following conclusions are based upon examination of certain indicator organisms, mostly insects or fish, at 239 stations examined and upon the appearance of the water. It should be remembered that water may be colourless and odourless but still may be bacterially polluted.

There is no doubt that the stream is polluted by cannery wastes at Otterville. This is a seasonal condition. The water had extensive growths of algae in it, there was marked turbidity and the odour was also foul. The Provincial Department of Health has already recommended the proper measures which should be taken to prevent further pollution of the river at this point. It only remains for these measures to be put in operation by the company involved.

In Tillsonburg, where there was a population in 1956 of 6,016, a system of sewers runs into a large septic tank, which is of old design. The effluent discharges directly into the Otter Creek. The treatment plant appears to be overloaded. The brief by the Pollution Control Board, dated September 1955, and entitled "The Present Status of Stream Pollution in Ontario", lists Tillsonburg as in need of a new treatment plant. Since Tillsonburg's population is increasing rapidly in spite of the serious setback caused by the very poor tobacco harvest in 1955, there is no doubt that a new and modern treatment plant is needed here. There is also room for improvement in the treatment of the primary waste from a milk processing plant at Tillsonburg. At Bayham and at Vienna

there are no serious pollution problems at present. At Port Burwell there are private septic tanks and also probably sewers passing into Lake Ontario. There are also some effluents passing directly into the river. At the present time there is not a serious problem, particularly since the sandy beach to the west of the breakwater is well separated from the mouth of the river. Provision of proper facilities at this beach will soon be a major requirement, but this area is not within the present boundary of the Otter Creek Conservation Authority.

The following comments concerning miscellaneous pollution make reference to stations which are marked on the map "Collection Stations", which may be found in the Wildlife section of this report. At station Yla10 there were many dead fish. At station Yla7 there was very marked pollution from cattle and very few insects alive in the water. At station Yld5 there was a dump on the bank of the stream. At station Y3t9 there was much trash dumped along the side of the river. At station Y2lb4 there were many dead fish, but pumps had been installed at this point for irrigation and this was probably the cause of the mortality. One section of **Stony Creek**, which is a trout stream, was pumped dry at least three times during the summer of 1955. This trend may, of course, be expected to increase except in very wet or very cool summers. Storage reservoirs which would conserve the spring run-off for irrigation use would remedy this condition.

Agricultural pollution did not appear to be important over the watershed as a whole.

It seems that there are three ways in which pollution can be effectively controlled in the Province of Ontario. The first is by improved technical methods in the operation of treatment plants, both industrial and municipal. The second is by the establishment of a permit system for the construction of all new effluent pipes or drains, large or small, which would empty into watercourses or natural bodies of water.

The third method is a much extended system of public education concerning pollution control directed both to individuals and corporations. This would particularly stress the need for prevention of the dumping of refuse along the edges of rivers or in their waters. This need is all the more important since the rivers of Southern Ontario are being increasingly used for irrigation, and a diminished flow must be expected, particularly in the Otter Creek Watershed. If a Pollution Control Advisory Board were formed within the Otter Creek Conservation Authority, special study might be given to some of the needs mentioned above.

3. Flood Protection

Flooding along the Otter Creek is not nearly as serious as on most of the other watersheds. However, from local newspapers, diaries and eye-witnesses, accounts of a number of floods dating from 1809 to the present have been obtained and it is noted that they have occurred more or less uniformly throughout this 147-year period of record.

Port Burwell, Vienna, Tillsonburg, Norwich and Otterville appear to be the critical areas, with the most persistent flooding occurring in the Tillsonburg area and particularly that low section of Highway No. 3 and the Borden plant at the westerly town limit.

Flooding at this point is often due to ice jams which form at a sharp bend in the river. At one time the Department of Highways were considering diverting the stream at this point, which would have eliminated the trouble to some extent, but this plan was abandoned in favour of moving the highway back from the river.

The Tillsonburg reservoir site is ideally located to provide effective flood control for this area and could easily be regulated as a dual-purpose unit to provide the necessary relief. The other reservoir sites, if constructed, would provide a good measure of local control, particularly during spring freshets when they were being filled.

If all the reservoir sites were developed, the storage available, with some minor local channel improvements, would be sufficient to control floods up to the magnitude of any on record but would not be sufficient to guarantee all-time protection against such greater floods as might occur in the future; although the peaks of these floods would be materially reduced with a corresponding decrease in the amount of flood damage sustained.

The village of Vienna, which has suffered severe flood damage, would receive a large degree of protection should the Acacia and Eden reservoirs be constructed.

In addition to the ice jams at Tillsonburg, Port Burwell has often suffered severe damage from "ice shoves", a condition which has been experienced by many of the ports situated along the lakes at river outlets. Ice shoves are usually due to a combination of (1) a heavy ice sheet forming in quiet backwaters from the lake, preventing ice floes from the river passing out into the lake, or (2) ice floes from the lake being piled up in the mouth of the river by strong on-shore winds coinciding with the river break-up.

In the case of the former, "ice channelling" through the heavy ice sheet prior to the river break-up offers some measure of relief and may prevent the formation of ice jams altogether. If the outlet is threatened by ice floes from the lake a tug might be employed to keep the mouth open. It is understood that ice channelling has been resorted to in the past and it is strongly recommended that it be continued as required.

When ice barriers are formed across the outlet from ice floes carried in from the lake, which may be further consolidated by freezing spray, blasting is the only feasible method of removing them.

Thermite* has been employed on occasions but this method did not prove too successful. Coating the ice formation with a dull dark substance which would absorb heat from the sun and hasten the melting of the ice has also been tried. In areas where large amounts of cinders are available this latter method provides an economical means of reducing the hazard.

It has been noted in one of the accounts of an early flood that considerable damage had been avoided at downstream municipalities as a result of warnings from residents further up the river. This practice should be continued. It would be worth while to organize or appoint residents along the streams who would alert the municipalities downstream when the river started to break up, in order that they might undertake precautionary measures to prevent an ice jam in their area or to remove goods from areas where ice and flood damage are known to occur.

The rate of run-off is by no means uniform over a watershed but normally increases from the lower end to the headwaters as the drainage areas decrease. With only one hydrometric gauge on the river at Vienna about 3 miles upstream from the mouth, it is difficult to determine accurately what the effect of the reservoirs would be on the individual flood problem, or the extent of work required for each, to give the desired relief. Additional gauges will be installed at strategic sites along the river and channel capacity flow observations made at each of the areas susceptible to flooding. in order to determine the most economical means of control.

The comparatively low flood damages in this area may also be attributed to the fact that the deep narrow valleys do not lend themselves to residential or commercial

* Thermite is a trade-name for a mixture of aluminum powder and a metallic oxide (usually iron) which develops a very intense heat when ignited.

development, and care should be taken in the future to ensure that such development of low-lying lands does not occur.

Bridges and roadways constructed across the valleys should be designed to cause as little obstruction of the flood flows as is economically possible.

Pond in Otterville Community Park. This former mill pond is the nucleus of the playgrounds and picnic areas developed at this point. The park is quite well-known throughout the district.



Settling basin for cannery effluent provides partial treatment by removing solid wastes.

Remains of the former Lake St. Joseph dam. This dam could be restored to create a large pond on Otter Creek at Tillsonburg.



CHAPTER 5

AVAILABLE CONSERVATION STORAGE

1. General

All the possible reservoir sites in the area were investigated and seven of these were selected for a more detailed study (Fig.1). These sites were surveyed and contour plans prepared from which the size of dams required for each and the storage capacities were determined.

The reservoir sites are fortunately well located strategically and would serve many purposes, namely: irrigation, increased flow to dilute pollution, sustain fish life and in conjunction with dikes and channel improvement would substantially reduce flood frequency.

Owing to the recent rapid growth and development of Canada, and of Southern Ontario in particular, it is difficult to visualize what the demand for water might be in 25 years or even 10 years and there is no reason why the Otter Creek Watershed should not share in the development unless there is not enough suitable water to satisfy the many requirements. At present the need for water is mainly for the irrigation of tobacco plantations but it may be required soon for specialized crops also and will, no doubt, be needed to dilute the effluent from sewage treatment and industrial plants and other domestic wastes which inevitably find their way into the streams. Many industries require water to process their products and this should be considered in future planning. Reservoirs that will impound surface spring run-off which normally goes to waste appear to be the most economical means of satisfying the water problems.

It is not suggested that all the dams be built until the need arises, but the Authority should acquire the sites now while land values are reasonable. If the land should be acquired for industry, golf clubs, or by individuals and buildings erected, the cost of the necessary lands alone could

make the future development of these projects exorbitant and even impossible. The present value of these lands should be less than that of the surrounding farmland since the land in question is chiefly bottom lands or steep wooded slopes which are not suitable for cultivation.

Many factors influence the cost of reservoirs but in general the height and length of the dam structure and the spillway capacity required to prevent its failure in the event of an exceptional flood are the chief factors. The extent of the area flooded by the impounded waters, its value, roads, bridges, railways and other services which have to be abandoned or re-located and clearing the flooded area are other factors affecting the cost of such projects.

As mentioned previously the valleys of the Otter Creek and its tributaries, owing to their narrow width and the steep stream gradients, do not lend themselves to low-cost storage. Because these valleys furnish relatively low storage capacities the unit costs are high but, with the exception of the Delmer site, these are not considered to be excessive in view of the benefits to be derived in the future.

Data for the dam and reservoir projects are shown in Table 5 at the end of this chapter and a brief description of each of the sites is given below. Contour plans for the Lower and Upper Tillsonburg sites are shown in Figures 6 and 7.

2. Reservoir Sites

(a) Acacia

The damsite is situated in Lot 22, Con. VII, Bayham Township on the East Branch of the Otter Creek about 1 mile upstream from No. 19 Highway.

The site is suitable for a dam 57 feet in height and 460 feet in length which would create a lake 4.7 miles long with an average width of 440 feet and a surface area of 325 acres. When full the lake would have a maximum depth at the

dam of 52 feet and a storage capacity of 7,090 acre feet.

With a drainage area of 36.3 square miles, this reservoir would control 76 per cent of the run-off from the East Branch.

The reservoir area covers parts of Lots 22 to 24, Con. VII and part of Lots 24 to 28, Con. VIII, Bayham Township and part of Lots 1 to 6, Con. II, Middleton Township. The major portion of this area consists of bottom lands and bush. Less than 10 per cent is used for farming and a good portion of this is in pasture.

The only buildings affected would be a group of 3 farm buildings on the road between Lots 2 and 3, Con. II, Middleton Township.

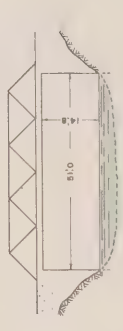
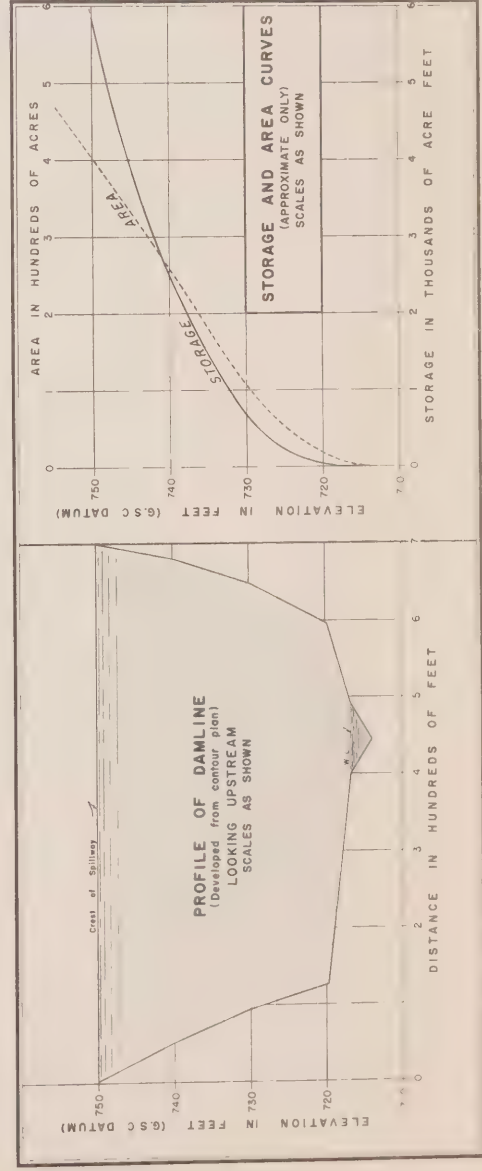
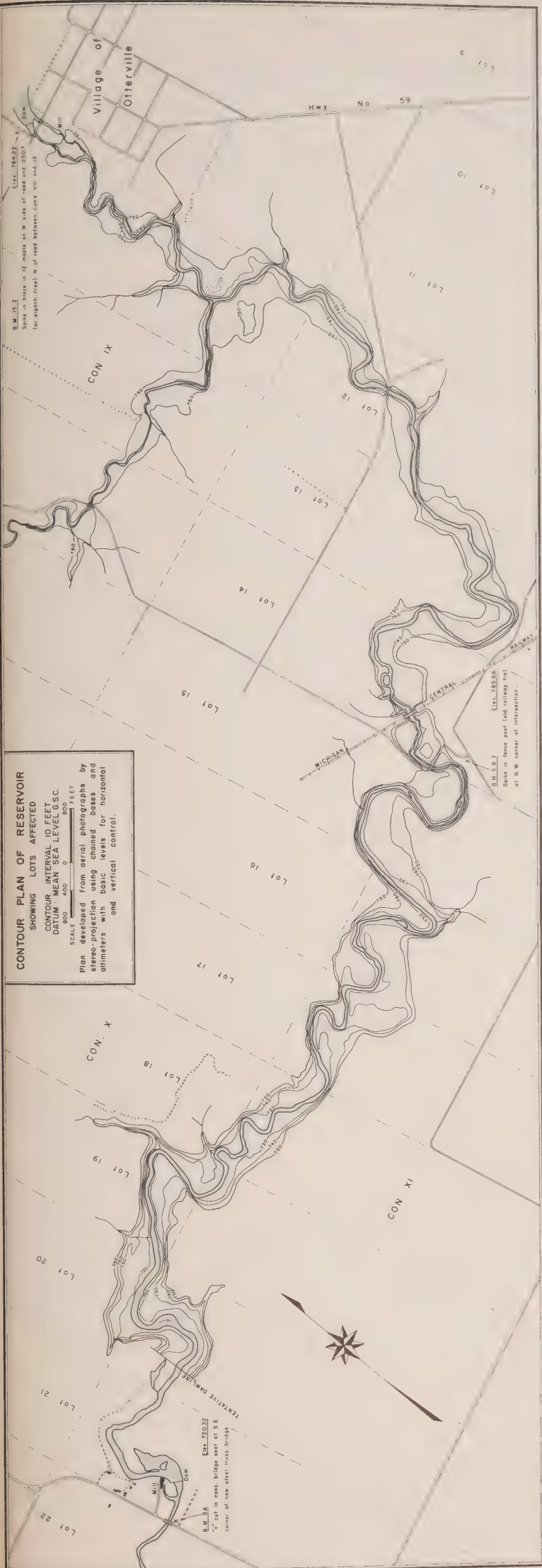
Two road crossings would be affected. At the first crossing in Lot 28, Con. VIII, Bayham Township, a small concrete bridge and box culvert would be flooded to a depth of 30 feet. Four roads converge at this crossing and a considerable length of roadway would have to be abandoned. At the second crossing on the road between Lots 2 and 3, Con. II, Middleton Township, a concrete culvert would be under 10 feet of water but little roadway would be affected.

(b) Eden

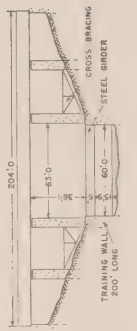
The damsite is situated in Lot 16, Con. IX, about 1,000 feet north of the road between Cons. VIII and IX, Bayham Township.

The proposed dam would be 49 feet high and 690 feet long with a maximum depth of water at the dam of 44 feet. When full the reservoir would be 4.4 miles long with an average width of 600 feet and a surface area of 412 acres. The maximum storage capacity would be 5,604 acre feet.

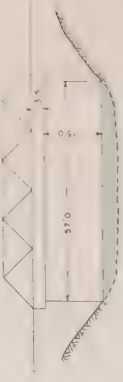
The drainage area above this site is 167.4 square miles or approximately 61 per cent of the total for Otter Creek.



Lot 14, Con's X-XI, Township of S. Norwich
 Old steel truss bridge, 13.0 wooden floor roadway
 POOR condition



Lot 14, Con. X, Township of S. Norwich
 Two track, decked plate girder, conc piers
 GOOD condition



Lot 12, Con. X, Township of S. Norwich
 Steel truss bridge, conc. abut's.—14'0 plank floor roadway
 POOR condition

OTTER CREEK WATERSHED
No. 5A - UPPER
TILLSONBURG RESERVOIR
 TOWNSHIP OF S. NORWICH
 COUNTY OF OXFORD
 ONTARIO DEPT. OF PLANNING AND DEVELOPMENT
 CONSERVATION BRANCH
 HON. W. M. NICKLE, MINISTER

FIG. 7

The valley below the flood line is chiefly covered with dense scrub bush with little arable land. There are no buildings within the flowage area but two roads and a railway line cross the site.

A steel truss bridge in Lot 19 on the road between Cons. IX and X, Bayham Township, and 800 feet of roadway would be flooded to a maximum depth of 20 feet. A second steel truss bridge and 1,200 feet of roadway in Lot 22, Con. X, Bayham Township, would be flooded to a maximum depth of 10 feet.

The railway bridge is at the upper limits of the reservoir. This is a high level bridge and would not be affected by the backwater of the reservoir.

(c) Lower Tillsonburg

The damsite is located near the townline road between Dereham and Norwich South Townships one mile upstream from the town of Tillsonburg. The dam would be of an earth-fill and concrete type construction, having a maximum height of 47 feet above the bed of the stream and an overall length of 750 feet. At the maximum water level (elevation 730 feet) the reservoir would extend upstream for a distance of 7.7 miles, have a maximum width of about 1,400 feet, a surface area of 360 acres and a storage capacity of 8,068 acre feet.

Two road crossings, a mill and dam would be affected by this reservoir. The abandoned road crossings would be compensated for in part by a road crossing over the dam. The mill could be converted to electric or diesel power and relocated outside the flowage area or perhaps at the proposed dam downstream where there would be a more adequate and reliable flow than is available at the present site. The lands in the reservoir area are partially wooded and the open spaces are chiefly unused bottom lands or pastures.

This is the best reservoir site in the watershed. It is centrally located, and controlling 126.5 square miles or

94 per cent of the total above the town of Tillsonburg, would provide effective flow regulation for this area where the flooding is most frequent and severe.

(d) Upper Tillsonburg

This damsite is located in Lot 20, Con. XI, Norwich South Township about $\frac{1}{2}$ mile upstream from the "Rock" mill and dam. The dam would be 41 feet high and 700 feet long and would raise the water 36 feet to elevation 750. At this maximum level the reservoir would be 4.5 miles long and impound 5,840 acre feet of water.

The land below the 750-foot flood contour is chiefly covered with bush of little economic value and the remaining open land is largely pasture. One road crossing with an old steel truss bridge would be flooded to a maximum depth of 10 feet over a length of 650 feet.

The high level Michigan Central Railway bridge located about midway in the reservoir would also be affected to some extent. For the maximum reservoir level of 750 feet there would be 31 feet clearance in the centre span but small sections of the steel cross-bracing between the piers on either side of the centre span would be submerged to a depth of 3 or 4 feet. Also the retaining walls confining the stream under the bridge would be submerged and the six-foot deep plate girder cross-braces between the walls would tend to obstruct the flow. However, as the stream velocities due to the backwater from the dam would be low, this effect would be slight. Also the effect of the backwater on the bridge would not be serious. Some protection would be required on the filled approaches and along the upstream side to protect the steel cross-bracing from being damaged by floating objects when the reservoir was full or nearly so.

This reservoir is a fair site being strategically located in the watershed for summer water supply and flood control but should only be considered in the event that the lower site is not available when the work is undertaken.

(e) Delmer

The damsite is situated on Stony Creek in Lot 15, Con. X, Dereham Township, approximately 1 mile upstream from the hamlet of Delmer.

The dam would be 46 feet high and 800 feet in length. At maximum water level the reservoir would have a depth of 41 feet at the dam, a length of 2 miles and a capacity of 1,270 acre feet.

The reservoir area, except for a small section of bush near the damsite, is mainly open pasture land. Two roads and a farm entrance would be affected.

Preliminary estimates indicate that the cost of this reservoir would be excessive and it is not considered feasible at this time.

(f) Otterville

The damsite is located on Branch Creek on the road between Lots 11 and 12, Con. VIII, South Norwich Township, just above the village of Otterville.

The dam would be 46 feet high above the bed of the river and 340 feet long and would create a lake 1.2 miles long with a surface area of 75 acres and a storage capacity of 1,140 acre feet.

This site, with a drainage area of 9.8 square miles would control all of Branch Creek but would not control sufficient area to give Otterville effective flood relief.

The reservoir area covers parts of Lots 12 and 13, Con. VIII, and part of Lot 11, Con. VII, South Norwich Township. The area, for the most part, is covered with scrub bush with some open land at the upper end. The land use survey in 1955 shows that 95 per cent of the open lands were being used for pasture and were of little value for any other purpose.

There are no buildings affected in this area but two road crossings would be flooded. A small masonry bridge

and about 250 feet of roadway on the road between Lots 11 and 12, Con. VIII, North Norwich Township, would be flooded to a maximum depth of 10 feet.

A second bridge in Lot 11 on the road between Cons. VII and VIII, North Norwich Township, would be flooded to a depth of 5 feet. However, very little roadway would be affected and the crossing could easily be re-established.

(g) Springford

The damsite is situated in Spitler Creek about one-half mile upstream from the road between Cons. VII and VIII, South Norwich Township.

The top of the dam would be 46 feet above the bed of the stream and 790 feet long. The reservoir at maximum water level would be 2 miles long with a surface area of 247 acres and a storage capacity of 3,900 acre feet.

The reservoir would include parts of Lots 24, 20 and 21, Con. VII, South Norwich Township and parts of Lots 20 to 24, Con. VI, North Norwich Township. Two groups of farm buildings and four road bridges would be affected.

The steel truss bridge on the road between Cons. VI and VII and 1,300 feet of roadway would be flooded to a maximum depth of 35 feet. A second bridge and some 500 feet of roadway would also be affected on this road at Lot 24. This is a concrete bridge and it would be submerged to a depth of 5 feet.

The road between Lots 21 and 22, Con. VI, North Norwich Township is affected in two places at the upper end of the reservoir where it splits into two arms. The upper arm would flood a small steel truss bridge and about 450 feet of roadway to a maximum depth of 10 feet. The lower arm would flood a second steel truss bridge and about 1,150 feet of roadway to a maximum depth of 25 feet. Between the two arms there is approximately 900 feet of this road above the proposed maximum water level which would be isolated.

TABLE 5

DAM AND RESERVOIR DATA FOR OTTER CREEK SITES

Reservoir	D A M						R E S E R V O I R				
	Drainage Area	Length	Height Above Stream Bed	ELEVATION G.S.C.			Spillway Capacity Not Less Than	At Maximum Water Level			
				Bed of Stream	Top of Spillway	Top of Dam		Length	Average Width	Surface Area	Storage Capacity
Sq. Miles	Feet	Feet	Feet	Feet	Feet	c. f. s.	Miles	Feet	Acres	Acre Feet	
(a) Acacia	36.3	460	57	88.0*	140.0*	145.0*	7,700	4.7	440	325	7,090
(b) Eden	167.4	690	49	56.0*	100.0*	105.0*	30,200	4.4	600	412	5,604
(c) Lower Tillsonburg	126.5	750	47	687.9	730.0	735.0	24,000	7.7	750	360	8,068
(d) Upper Tillsonburg†	119.7	700	41	714.0	750.0	755.0	22,800	4.5	597	404	5,840
(e) Delmer**	8.8	800	46	99.0*	140.0*	145.0*	1,920	2.0	375	109	1,270
(f) Otterville	9.8	340	46	759.0	800.0	805.0	2,140	1.2	346	75	1,140
(g) Springfield	32.6	790	46	794.0	835.0	840.0	6,900	2.0	753	247	3,900

* Assumed datum

† Possible alternative site to Lower Tillsonburg

** Site not considered feasible at present time.

CHAPTER 6

COMMUNITY PONDS

Community ponds, as referred to here, are public ponds, usually larger than the private farm ponds, which may be used to provide bathing, fishing and boating during the summer months and skating and hockey during the winter months or, if conveniently located to an urban centre, as a source of water for domestic supply and/or fire protection. It is well known that water, whether in a flowing stream or pond greatly enhances the recreational value of park areas by providing these additional facilities and there is no doubt as to the value of an adequate water supply in the event of a major fire.

There are many stretches of streams in the Otter Creek area which, in their present natural state, would make attractive sites for community parks provided the quality and quantity of the stream flow could be depended upon. The conservation reservoirs outlined in the previous chapter would assure an abundance of good water in the streams below the dams.

In some areas the streams may be of sufficient width and depth to offer adequate water facilities but in others small dams may be required to create a pool of sufficient size to serve the purpose. In these areas removable timber dams as illustrated in the accompanying photograph could be constructed at reasonable cost.

Existing ponds on the watershed, provided suitable adjacent lands are available for picnic and playground areas, could also be developed for these centres. The community park at Otterville which was founded at the turn of the century, would serve as a good example for other community centres. A description of this park is quoted in part from the Brantford Expositor dated May 11 1938.

"Perhaps the major attraction of Otterville to-day is the South Norwich Community Park and Athletic Fields, on the beautifully wooded banks of the Otter River, just opposite the business section of the village. For a number of years this park with

"its splendid facilities for swimming and fishing and for other forms of recreation in the way of tennis courts, ball diamonds, picnic conveniences, dance hall, and the like has proved a veritable mecca for picnickers and visitors for many miles around."

Former millsites with their added historical interests, provided suitable lands for recreation facilities can be made available, can be developed into good community centres. During the 1955 survey 35 old millsites were investigated. Most of the sites were unsuitable for community centres and were eliminated. Five, however, were selected as a choice for consideration, their locations being shown below and also in Fig. 1.

MILLSITES

Designated Number	Lot	Con.	Township	Owner or Last Operator	Date Built
1	19	3	Bayham	Jas. Beard	1873
9	11	6	"	Frank McQuiggan	?
11	17	8	"	Mr. Stenabaugh	?
23	11	8 & 9	South Norwich	L. Treffry	1830 _±
29	3	12	" "	E.D. Tillson	?

The Lake St. Joseph site, owing to its central location in the watershed and being close to the town of Tillsonburg is an ideal site for a community pond provided enough land is available for recreation purposes.

In this regard reference is made to a report by John F. Weston, M.E.I.C., P.Eng., O.L.S., dated October 12, 1955, who was engaged by the Authority to prepare preliminary plans and report on the estimated cost of replacing the dam. The estimated cost, according to the report, to construct the dam would be "at least seventy to seventy-five thousand dollars".



In areas where the natural stream does not have sufficient width or depth small removable timber dams, as illustrated above, may be constructed at reasonable cost to provide a temporary pool.

CHAPTER 7

FIELD SURVEYS

The field surveys undertaken were necessarily of a preliminary nature but were of sufficient accuracy and extent to fulfil the needs of this study.

A reconnaissance of the area was made and a number of reservoir sites located. These sites were then examined in more detail and seven of the best were selected to be surveyed for the preparation of contour plans by stereo-projection from aerial photographs.

The contour plans of the Upper and Lower Tillsonburg sites and the Acacia and Eden sites were prepared by the Photographic Survey Corporation Ltd. from field survey data supplied by the Conservation Branch. These plans were drawn at a scale of 400 feet to the inch with 10-foot contours. The horizontal scale of the photographs was accurately determined by check-chaining stretches of roads or fence-lines between points which could readily be identified on the photographs and comparing the distance between these points scaled from the photographs to the actual distance measured along the ground between the same two points.

The vertical control for the mapping was obtained by check lines of levels between bench marks established at the lower and upper ends of each reservoir area. Intermediate spot elevations between these two established points were determined by means of the Wallace and Tiernan type F.A. 176 precise altimeters. The storage capacities measured from the plans prepared from these surveys are believed to be correct within 5 per cent.

For the smaller sites of Springford, Otterville and Delmer the contour plans were prepared by the Conservation Branch from aerial photographs by means of the Fairchild Stereo-comparagraph. For these surveys bench marks were established at each end of the sites and a line of levels run

around the perimeter of the reservoir areas. Points at convenient intervals were identified on the photographs and the elevations noted. From these points the valleys were cross-sectioned by means of the altimeters and the elevations again being noted on the photographs. The stereo-comparagraph was then used to complete the contour lines between sections to give contour plans at a horizontal scale of approximately 1,000 feet to the inch with 10-foot contour intervals. The horizontal scale was determined in the same manner as the first group. Storage capacities for these reservoirs determined from these plans are considered to be within 20 per cent of the true value which is sufficient accuracy for this preliminary study.

In carrying out the above work levels were run from the Geodetic Survey of Canada bench mark No. 1705 in Woodstock to the Tillsonburg, Otterville and Springford reservoir sites. In all approximately 30 miles of levels were run on this datum and 28 bench marks were established within the watershed. These bench marks will expedite any future work in the area particularly should it be decided to proceed with the construction of a reservoir.

The surveys for the Acacia, Eden and Delmer sites were made on assumed data.

Approximately 14 miles of levels were run for this part of the work and 21 bench marks were established. These levels could be readily tied into the other levels to form a fairly widespread network of bench marks referenced to the Geodetic Survey of Canada datum.

CHAPTER 8

SUMMARY

In the foregoing report the general physical features of the area under study have been described. These include the size and shape of the area, type of soils, topographical features, length and gradients of streams and the municipalities within the area.

The history of flooding together with an account of the more serious ones has been recorded. These accounts cover the period from 1809 to 1956 and show that at least 25 floods have been recorded in the past 147 years.

The hydrology of the area is outlined in Chapter 3. This includes a summary of the available precipitation and stream flow records and points out that while the average annual rainfall for the area for the period of records is 34.3 inches, annual rainfalls as low as 26.6 inches have been recorded.

The stream flows recorded at Vienna indicated that high flows usually occur in the late winter and early spring when the demand for water is least. Low flows are generally recorded in August, September and October. Stream flow records have only been kept since 1948 but in this short period a monthly mean flow of 56 c.f.s. and a minimum daily flow of 30 c.f.s. have been recorded. These flows represent the total drainage from an area of 263 square miles and it will readily be realized that under such conditions many of the smaller tributary streams would be bone-dry.

In addition to the high spring flows recorded, greater flows may be expected to occur in the future and must be taken into account when considering flow regulation structures such as dams. Studies have indicated that a maximum probable hurricane storm could produce a peak flow of 26,700 c.f.s. from this area while the peak flow resulting from the maximum 6-hour thunderstorm would amount to 43,500 c.f.s. or

a run-off rate of 165 cubic feet per second per square mile. This rate with small adjustments for drainage area size is the minimum recommended for spillway capacity design.

Pollution in the streams except at a few isolated points is not too serious at present but strict measures will be required shortly to safeguard the streams. Effluents from canneries and milk processing plants contaminate the water and a sewage treatment plant is required at Tillsonburg to take care of the domestic sewage which enters the Otter Creek at that point. Existing legislation will have to be strengthened and a program of public education concerning pollution control instituted to safeguard the quality of the water of the streams.

The problem of maintaining adequate water supplies for irrigation is the most pressing one on the watershed at this time. Large volumes of water are being withdrawn from ground water storage and directly from the streams to the detriment of other water users. It is estimated that the average moisture deficiency amounts to 3 inches during the period July 1 to August 15 and that at least 4.0 inches should be provided for this period to prevent crop losses through drought. On the basis of the tobacco crop alone, a minimum of 2,300 acre feet of storage is required for present needs with the demand probably increasing to over 15,000 acre feet in the near future.

An extensive study of the ground water resources of the area, which is beyond the scope of this report, is required to determine the available yield and the ultimate effect of withdrawing large volumes of water from this source. This study would necessarily be a long-term one and would require daily observations of rainfall, stream flows and ground water levels over a period of years. Also a survey should be undertaken to determine the capacity and extent of the aquifers.

It is believed that the present withdrawal of water from the streams and ground water will, sooner or later, affect the overall water supplies of the area and that it will be necessary to construct large impounding reservoirs.

Flooding has caused considerable damage to many of the municipalities in the past and, as pointed out in the chapter on Hydrology, even greater floods can occur and must be provided for when considering control measures. Floods in this area, like most areas in Southern Ontario, usually occur during a winter thaw or at the spring break-up. Many of these floods result from ice jams forming in the river, while others may be attributed to encroachment of the flood plain. Floods have also been experienced in the summer or early fall months due to heavy rainfall alone without the aid of snow-melt runoff or ice jams.

The reservoirs needed to satisfy the water demands of the area are strategically located for flood control purposes and if efficiently operated, would provide the necessary protection for all floods up to the magnitude of the greatest recorded for this area.

All the possible reservoir sites on the watershed were investigated and seven of the best were surveyed. Contour plans were prepared for each from which the size of dam required and the storage capacity were determined.

A description of each of the sites surveyed is given in Chapter 5 and the dam and reservoir data are summarized in Table 5. Of the seven sites surveyed five are well located as water-supply and flood control reservoirs and immediate steps should be taken to acquire the necessary lands to safeguard these sites for future development.

In addition to large reservoirs, community ponds which would serve either for recreation or as a source of limited water supply for domestic use or fire protection are also recommended. Often existing ponds may be acquired,

former ponds restored or new sites developed to serve one or more of the above requirements. Existing ponds or former pond sites, particularly those that have some historical background, are preferred. A number of such sites were briefly investigated and are listed in the foregoing report as a guide to the Authority in laying out a community ponds program.

The field surveys for this work were of a preliminary nature but were considered adequate for the scope of this report. Plans have been prepared and are available when required and a fairly extensive network of bench marks has been established in the area. The plans will be valuable for more detailed studies of the problems and the network of bench marks would greatly expedite any construction work that may be undertaken.

APPENDIX A
ESTIMATE OF IRRIGATION WATER REQUIREMENTS
DELHI AREA

Introduction

In order to assess reasonably the economic value of artificial storage of water for tobacco irrigation, it is necessary to know how frequently various amounts of water are required. The following Tables II and V give probabilities of requiring various amounts of irrigation water during the tobacco growing season. These were obtained by methods suggested by van Bavel (1) and Robertson (3).

1. Assumptions in Method

The following calculations of moisture deficiencies at Delhi have been made from available meteorological data by a daily moisture budget tabulation based on the following assumptions:

(1) A typical tobacco soil within the root zone of tobacco plants has a water storage capacity of one inch.

(References 1 and 2)

(2) Weekly figures for potential evapotranspiration (P.E.) calculated from 15-year averages of temperature by the simplified Thornthwaite formula ($P.E. = 0.1 (T-32)$) are sufficiently accurate estimates of P.E. (Any errors introduced by this assumption would likely be small and self-compensating rather than cumulative.)

(3) The irrigation season for tobacco in the Delhi area is approximately June 1 to August 15.

(4) The general assumptions of the daily moisture budget method for computing water deficiencies are valid for tobacco crop irrigation calculations. (Reference 3)

2. Results

The tabulations were made for each of the 20 years of record (1937-56). Monthly and seasonal totals are given in Table I.

(ii)
TABLE I
Moisture Deficiencies (inches) - Delhi

Year	June	July	Aug. 1-15	Total
1937	.30	1.95	1.04	3.29
38	2.59	1.77	0	4.36
39	2.35	2.84	.17	5.36
40	1.30	2.96	.93	5.19
41	1.62	1.72	1.16	4.50
42	1.93	1.32	1.08	4.33
43	.02	1.23	.30	1.55
44	1.13	3.23	1.11	5.47
45	.22	1.40	1.33	2.95
46	1.67	3.19	1.27	6.13
47	1.39	1.47	1.75	4.61
48	1.46	2.79	1.55	5.80
49	2.77	1.71	1.62	5.10
50	2.20	.36	.99	3.55
51	.88	.91	1.43	3.22
52	3.36	2.26	.04	5.66
53	1.94	2.68	.79	5.41
54	1.97	2.99	.62	5.58
55	2.41	2.04	.43	4.88
56	2.89	2.08	.64	5.61

Average seasonal deficiency = 4.68"

Standard deviation σ = 1.19"

3. Probability and Frequency Analysis

If the total seasonal deficiency figures can be assumed to form a normal distribution, the probability of the occurrence of seasonal deficiencies exceeding various amounts can be obtained from normal curve tables.

Results of the probability determinations are as in Table II.

(iii)

TABLE II

Probability Table for June 1 - Aug. 15
Moisture Deficits

Deficit Amount	% Probability of Deficit Greater than Amount
5.00"	39.4
5.50"	24.5
6.00"	13.4
6.50"	6.3

In other words, approximately once every four years the moisture deficiency will be $5\frac{1}{2}$ " or greater, and once every 16 years the moisture deficiency will be $6\frac{1}{2}$ " or greater.

4. Evaluation of Results

These figures are, of course, higher than would be obtained by the Thornthwaite technique used on a monthly basis, assuming a soil moisture storage of 4 inches. Their relation to present and future irrigation water requirements depends largely on the methods that are used by the farmers to determine dates and amounts of water to apply to the crop. Of 5 irrigation scheduling methods used in tobacco growing, 2 would be likely to give close correspondence of water use to the above figures. These are the moisture budget method (ref.3) and the weekly schedule method. (The latter goes by the rule that irrigation water plus rain must equal one inch per week during the season June 1 to August 15. This implies that average P.E. during this season is 1" per week. Our figures show 1" for June and August and 1.1" for July, which is close correspondence.)

Figures, on water quantities actually used for irrigation of tobacco, were available only for the Delhi experimental farm and for the years 1954, 1955 and 1956. Table I shows fairly high deficiencies for the month of June in each of these 3 years, yet from the Delhi figures, no June

(iv)

irrigation was undertaken in any of these years. However, if the calculated figures for June deficiencies are ignored, the computed water requirements and the actual water used are in good agreement as shown in Table III.

TABLE III
Calculated vs. Actual Irrigation Amounts

Year	Calculated Def. July 1-Aug. 15	Irrigation Amount Applied July 1 - August 15
1954	3.61	3.6
1955	2.47	2.7
1956	2.72	2.7

This suggests that either (a) favourable growth conditions during June may require that the soil be frequently dry to force the plants to root deeply or (b) that additional benefits would be obtained by irrigating during June.

If the former (a) is the case, then the total irrigation requirements should be obtained from the moisture deficiencies for the period July 1 to August 15 only. The totals for these periods are as in Table IV.

TABLE IV
Moisture Deficits
July 1 - August 15

Year	Deficit (ins.)	Year	Deficit (ins.)	Year	Deficit (ins.)
1937	2.99	1944	4.34	1951	2.34
1938	1.77	1945	2.73	1952	2.30
1939	3.01	1946	4.46	1953	3.47
1940	3.89	1947	3.22	1954	3.61
1941	2.88	1948	4.34	1955	2.47
1942	2.40	1949	3.33	1956	2.72
1943	1.53	1950	1.35		

Average deficit = 2.96"

Standard deviation σ = .88"

Assuming normal distribution this table gives deficiency probabilities as in Table V.

TABLE V
Probability Table for July 1 - August 15
Moisture Deficits

Deficit Greater Than	% Probability
3.00"	48.0
3.50"	27.1
4.00"	11.9
4.50"	4.0

This implies then that about once every 4 years a deficit greater than 3.5" will occur, about once every 8 years a deficit greater than 4" and once every 25 years a deficit greater than 4.5".

References:

- 1) van Bavel, C.H.M., "A Drought Criterion and Its Application in Evaluating Drought Incidence and Hazard". Agronomy Journal, Vol. 45, No. 4, April 1953, pp. 167-171.
- 2) Walker, E.K., "Recommended Practices for Flue-Cured Tobacco Irrigation". Proceedings of First Ontario Irrigation Conference, Feb. 1956, pp. 14-15.
- 3) Robertson, G.W., "Estimating Irrigation Water Requirement from Meteorological Data". Proc. of First Ontario Irrigation Conference, Feb. 1956, pp. 1-7.

ABBREVIATIONS, EQUIVALENTS AND DEFINITIONS

Abbreviations

ac. ft.	is the abbreviation for <u>acre foot</u> which is equivalent to 43,560 cubic feet and is the quantity of water required to cover one acre to a depth of one foot.
c.s.m.	is the abbreviation for <u>cubic feet per second per square mile</u> and is the average number of cubic feet of water flowing per second from each square mile of drainage area.
c.f.s.	is the abbreviation for <u>cubic feet per second</u> and is the unit generally used to express discharge or the rate of flow.
M.P.N. or m.p.n.	most probable number
ML or ml.	millilitre
P.P.B. or p.p.b.	parts per billion
P.P.M. or p.p.m.	parts per million
PH or ph	value measure of acidity or alkalinity

Equivalents

1 c.f.s.	= 6.25 imperial gallons per second
1 c.f.s. for 1 day	= 1.98347 acre feet or approximately 2 acre feet
1 c.f.s. for 1 year	= 724 acre feet
1 ac. ft.	= 271,472 imperial gallons
1,000,000 imperial gallons per day	= 1.86 c.f.s.

Definitions

BOOST STORAGE is the storage required to increase the head of water over the discharge tubes in order that they may be able to discharge the required flow.

CHANNEL CAPACITY or "IN-BANK" FLOW is the maximum flow which is contained within the river banks and does not overflow the adjacent low lands.

CHANNEL CAPACITY STORAGE is the volume of water that must be impounded in order that the stream flow will not exceed the channel capacity flow or stage.

(ii)

CONSERVATION STORAGE is that volume of water remaining in a reservoir which may be used to augment the low flows and is equivalent to the maximum storage capacity of the reservoir less the dead storage, evaporation and ice losses and the space reserved for flash floods.

DAM is a structure in and across a river valley to impound, control and otherwise regulate the river flow.

DEAD STORAGE is the amount of water kept in a reservoir at all times for the purpose of protecting the artificial and natural water seals at the base of the dam.

DISCHARGE TUBE or CONDUIT is an opening through the base of the spillway to provide means for discharging water when the water level of the reservoir is below the spillway level.

FLOOD is an overflow or inundation coming from a river or other body of water.

FLOOD CONTROL is the prevention of flooding by controlling the high water stages by means of storage reservoirs, dikes, diversions or channel improvement such as widening, deepening and straightening.

FLOOD CONTROL STORAGE is the total volume of water that must be impounded during a given flood in order that the stream flow will not exceed the channel capacity flow or stage and is equal to the sum of the channel capacity, dead, boost and operational storages.

FLOOD CREST is the maximum height or stage that the flood waters reach during any one flood period.

FLOOD HYDROGRAPH - a hydrograph which covers only the flood period or time interval during which the river flow is above the flood stage.

FLOOD RATIO is the rate of peak flow to the average flow for the flood period.

FLOOD STAGE is an arbitrary flow stage which varies from place to place and from season to season and is that flow or water level at which the water threatens to do damage.

FREEBOARD is the vertical distance between the maximum permissible water level and the top of the dam or dikes.

HYDRAULICS as applied to conservation deals with the measurement and control of run-off from river drainage basins.

HYDROGRAPH is a plot of flow against time and is a correct expression of the detailed run-off of a stream resulting from all the varying physical conditions which have occurred on the drainage area above the gauging station previous to the time which it represents.

(iii)

HYDROLOGY is the science which deals with the occurrence and distribution of water in its various forms over and within the earth's surface. As applied to conservation it deals more specifically with that portion of the hydrologic cycle from precipitation to re-evaporation or return of the water to the seas and embodies the meteorological phenomena which influence the behaviour of the waters during this phase of the cycle.

OPERATIONAL STORAGE is additional storage that is required to provide a safety factor to enable the controller to regulate the discharge from a dam so as not to exceed the channel capacity flow or stage.

RATE OF RUN-OFF is the rate at which water drains from an area. Usually expressed in cubic feet per second (c.f.s.).

RATE OF RUN-OFF PER SQUARE MILE is the average number of cubic feet per second of water flowing from each square mile of area drained (c.f.s./sq. mi. or c.s.m.).

RESERVOIR is the body of water created by the construction of a dam.

RESERVOIR CAPACITY is the maximum amount of water that may be contained within the reservoir without exceeding the maximum permissible water level. Usually expressed in acre feet.

RUN-OFF is the amount of water which reaches the open stream channels and may be broadly defined as the excess of precipitation over evaporation, transpiration and deep-seepage.

RUN-OFF DEPTH IN INCHES is the depth to which the area would be covered if all the water flowing from it were conserved and uniformly distributed over the surface.

SPILLWAY is that part of a dam over or through which the water is discharged.

SPILLWAY CAPACITY is the maximum amount of water that may be discharged over the spillway without exceeding the maximum permissible water level in the reservoir.

STREAM GAUGE is a measuring device used to determine the elevation of the water surface at selected points - usually a graduated rod fixed in an upright position and set to a known elevation from which the gauge readings are obtained by direct observation. Automatic type gauge is a mechanically operated recording instrument which gives a continuous record of water surface elevations.

WATER or CLIMATIC YEAR is a 12-month period from October 1 to September 30. The water year was found to be a more convenient form than the calendar year for the purpose of stream flow studies as it groups together those months in which the water losses due to evaporation and vegetation demands are at a minimum (October - March) and those during which the losses are high (April - September).

WILDLIFE

CHAPTER 1
INTRODUCTION

Apart from fish, the wildlife of Southern Ontario is not of great economic importance. Only the money derived by the fur trapper from the sale of furs is a useful direct source of income. However, a great deal of business is carried on with mutual benefit to the sportsman and the sporting goods dealer, and an ever increasing number of naturalists, photographers and other private citizens enjoy great satisfaction from seeing the varied forms of wildlife in attractive environments.

With proper handling of the places in which the various kinds of wildlife live, and by managing their numbers, wildlife populations should have no adverse effect on most good land use practices. The best farm husbandry commonly goes hand in hand with good wildlife conditions. Thus the control of undesirable or harmful species of animals and the maintenance of the more desirable or spectacular and interesting species by habitat manipulation, hunting, fishing, trapping and other sound wildlife management techniques, becomes an essential branch of good land management.

On the Otter Creek Watershed, as in much of the rest of Southern Ontario, a shortage of good wildlife habitat is usually the most important single factor limiting the wildlife population. Over-hunting, over-fishing and predation have contributed to the depletion of some species in its final stages. The Provincial Government is now able to exercise control over most of these factors. Considerable research is still being carried on in the methods of management of wildlife populations. This report covers only the distribution of stream fish, the biological conditions of the streams, and the most generally acceptable methods of improving farms for wildlife, together with a list of birds that may be expected to nest in the area.

CHAPTER 2

IMPROVING THE LAND FOR WILDLIFE

There are many varied types of land in the Otter Creek Watershed. The requirements of food and cover vary greatly for different species of wildlife. The recommendations here listed are therefore those which can be most generally applied by the landowner.

1. Woodlands

The elimination of grazing of woodlots would be the most useful single measure in improving the wildlife environment. Reforestation plans are included in the Forestry report. In plantations, up to about the tenth year from planting, the entire planted area is valuable for wildlife. But large blocks of coniferous trees will, at least after the twelfth year from planting, have little or no undergrowth and will, apart from their edges, be comparatively sterile as far as upland game and most forms of wildlife are concerned. The chief improvements to be expected will, therefore, come from good management of the farm woodlot. Selective cutting is both sound forestry practice and good planning for wildlife. Landowners who have woodlots in which the crown canopy has closed over considerable areas, and who wish to produce a proper environment for wildlife, will find that release cuttings, slashings to stimulate sprout growth, thinnings and felling timber for sale will improve rather than retard the carrying capacity for wildlife. Construction of brush piles from cuttings is recommended where rabbits are desired, two or three such brush piles per acre being the normal spacing.

2. Cultivation Practices

All good farming practices which make a more luxuriant vegetation will improve the farm environment for wildlife. A few special practices will give more specific

THE FIRST CHAPTER

The first chapter of the book is devoted to a general survey of the subject. It begins with a definition of the term "philosophy" and then proceeds to a discussion of the various branches of the subject. The author then discusses the history of philosophy and the different schools of thought that have developed over the centuries. Finally, he discusses the relationship between philosophy and other sciences.

THE SECOND CHAPTER

The second chapter is devoted to a discussion of the philosophy of knowledge. It begins with a discussion of the nature of knowledge and the different ways in which it can be acquired. The author then discusses the different theories of knowledge and the problems that have arisen in connection with them. Finally, he discusses the relationship between knowledge and reality.

The third chapter is devoted to a discussion of the philosophy of ethics. It begins with a discussion of the nature of ethics and the different ways in which it can be applied. The author then discusses the different theories of ethics and the problems that have arisen in connection with them. Finally, he discusses the relationship between ethics and other sciences.

benefits. Strip-cropping, described elsewhere in this report, is of particular value since by this means no extensive area is denuded of cover at one time by harvesting. This is of particular importance in an area such as the Otter Creek Watershed, where tobacco growing leaves many fields open much of the year. In the less flat parts of the watershed, filter strips, either above water-diversion terraces or used as emergency waterways, provide travel lanes and nesting cover for wildlife. Cover crops such as the clovers provide a habitat and food for wildlife in areas that would otherwise be barren during the winter months.

The elimination of brushy fencerows is now becoming more common in the Otter Creek Watershed. Those who are interested in wildlife improvement will find that the inclusion of a few field boundary hedges on the farm will moderate the effect of winds on crops, serve as travel lanes and cover for wildlife, and harbour large numbers of songbirds which help to control insect pests. Inevitably the presence of boundary hedges on a farm tends to encourage the growth of weeds. This is the price that must be paid for improved wildlife conditions. Rosa multiflora is an excellent hedge-forming shrub. It has a tendency in Southern Ontario to die back in winter, but rapidly forms a dense hedge, which is reported to be proof against cattle and hogs. It provides both cover and food and does not exhaust the nearby cultivated ground. However, in view of its questionable hardiness, it should not be planted in the Otter Creek Watershed without consultation with the nearest biologist or forester of the Department of Lands and Forests, at Aylmer.

3. Cover Patches

Field corners are frequently barren of crops. Therefore a fence crossing which embraces the corners of four fields may be made into a haven for ground-nesting species

by planting a few trees and shrubs and protecting them. It is important to rid such areas of useless weeds by crowding them out with useful species such as white sweet clover or the normal climax type of open vegetation, which is bluegrass.

4. Ponds and Streams

The importance of water to wildlife is often forgotten. Many farms have at least one low spot where a small amount of work with a scoop will provide a dam and a pond to provide nesting and feeding sites for water and marsh birds. If possible, ponds for wildlife should be separate from those intended for cattle or for fish.

The present practice of leaving the spoil banks piled at a steep slope around the edges of new irrigation ponds seems to be a disadvantage to the farmer. Willow cuttings pushed in the ground around hollows will rapidly provide wildlife cover. New water areas are usually very rapidly invaded by aquatic plants, but additional species may have to be introduced. No extensive duck food studies have been made in Southern Ontario. Wild rice may be introduced, but since it is not well adapted to wide variations in water levels, being often sterile in fluctuating waters, it cannot be considered as certain to succeed. The idea has long been current, and fostered by many sportsmen's organizations, that the planting of wild rice is the answer to the problem of how to attract ducks to any area. The fact is that wild rice is of little significance to ducks in Canada except in the fall, and does not provide good cover or nesting sites. The following species which may be easily obtained are recommended as certain to be valuable duck foods. If none of them occur in ponds or shallows with good cover for ducks they can be introduced.

Sago Pondweed
Red-Head Pondweed
Wild Millet

Potamogeton pectinatus L.
Potamogeton Richardsonii
(Ar. Benn.) Rydb.
Echinochloa crusgalli (L) Beauv.

Japanese Millet	<u>Echinochloa frumentacea (Roxb) Link</u>
Wild Celery	<u>Vallisneria americana Michx.</u>
Knotweed	<u>Polygonum pensylvanicum L.</u>
Water-Smartweed	<u>Polygonum coccineum Muhl.</u>
Three-square	<u>Scirpus americanus Pers.</u>
Great Bulrush	<u>Scirpus validus Vahl., var.</u> <u>creber Fern.</u>
Duckweed	<u>Spirodela sp. and Lemna sp.</u>

Those who are interested in farm ponds for wildlife will find very useful details of the various types of pond and methods for constructing each type in a booklet "Farm Ponds" which is available from the Provincial Government. Farm ponds differ from those intended for wildlife in that care is usually taken to prevent the growth of aquatic vegetation in a farm pond intended only for watering stock or fire protection purposes. Otherwise the construction and details of ponds for wildlife should follow one of the types there described.

5. Present Species of Wildlife

The only detailed studies of the distribution of mammals in the vicinity of the Otter Creek Watershed are those by Snyder and Logier*, Downing†, and Saunders**. Most of the work here mentioned as carried out was concentrated in the Long Point area, which adjoins the Otter Creek Watershed, and which includes several types of vegetation and cover not found in the Otter Creek Watershed. It is therefore not considered justifiable to include such records as a list of the mammals of this area.

To some extent the same remarks apply to the birds of this watershed. There is little doubt that between 270 and 290 species of birds do migrate through the watershed

* Snyder, L.L., and E.B.S. Logier. A faunal investigation of Long Point and vicinity, Norfolk County, Ontario. Trans. Roy. Can. Inst., XVIII (part 1): 117-236. 1931.

† Downing, S.C. A provisional check list of the mammals of Ontario. Roy. Ont. Mus. Zool. Misc. Pub. No. 2. 1948.

** Saunders, W.E. Notes on the mammals of Ontario. Trans. Roy. Can. Inst. (Part 2): 271-309. 1932.

or live in it at some time of the year. The following list includes only those that may be expected to nest regularly in the area. The names and order follow those of L.L. Snyder in "Ontario Birds", Toronto.

Pied-billed Grebe	Black-capped Chickadee
Great Blue Heron	White-breasted Nuthatch
Green Heron	House Wren
American Bittern	Marsh Wren
Mallard	Sedge Wren
Black Duck	Catbird
Blue-winged Teal	Brown Thrasher
Wood Duck	Robin
Sharp-shinned Hawk	Wood Thrush
Cooper's Hawk	Veery
Red-tailed Hawk	Bluebird
Red-shouldered Hawk	Cedar Waxwing
Marsh Hawk	Great Shrike
Sparrow Hawk	Starling
Ruffed Grouse	Yellow-throated Vireo
Common Pheasant	Red-eyed Vireo
Virginia Rail	Warbling Vireo
Sora	Black and White Warbler
Gallinule	Golden-winged Warbler
Killdeer	Yellow Warbler
American Woodcock	Black-throated Green Warbler
Upland Plover	Cerulean Warbler
Spotted Sandpiper	Chestnut-sided Warbler
Black Tern	Pine Warbler
Rock Dove	Prairie Warbler
Mourning Dove	Oven-bird
Screech Owl	Mourning Warbler
Horned Owl	Maryland Yellow-throat
Long-eared Owl	Canada Warbler
Whip-poor-will	American Redstart
Nighthawk	House Sparrow
Chimney Swift	Bobolink
Ruby-throated Humming- bird	Eastern Meadowlark
Belted Kingfisher	Red-wing
Yellow-shafted Flicker	Orchard Oriole
Pileated Woodpecker	Baltimore Oriole
Red-headed Woodpecker	Grackle
Hairy Woodpecker	Cowbird
Downy Woodpecker	Scarlet Tanager
Eastern Kingbird	Cardinal
Crested Flycatcher	Rose-breasted Grosbeak
Eastern Phoebe	Indigo Bunting
Traill's Flycatcher	Purple Finch
Least Flycatcher	American Goldfinch
Eastern Wood Pewee	Towhee
Horned Lark	Savannah Sparrow
Tree Swallow	Grasshopper Sparrow
Bank Swallow	Henslow's Sparrow
Rough-winged Swallow	Vesper Sparrow
Barn Swallow	Slate-colored Junco
Cliff Swallow	Chipping Sparrow
Purple Martin	Field Sparrow
Blue Jay	Swamp Sparrow
Crow	Song Sparrow

CHAPTER 3

FISH

1. Introduction

Stream surveys in the Otter Creek drainage basin in 1955 were restricted to three types of work.

(a) A general classification of the waters of the drainage basin defining the suitability of the various parts for different species of fish.

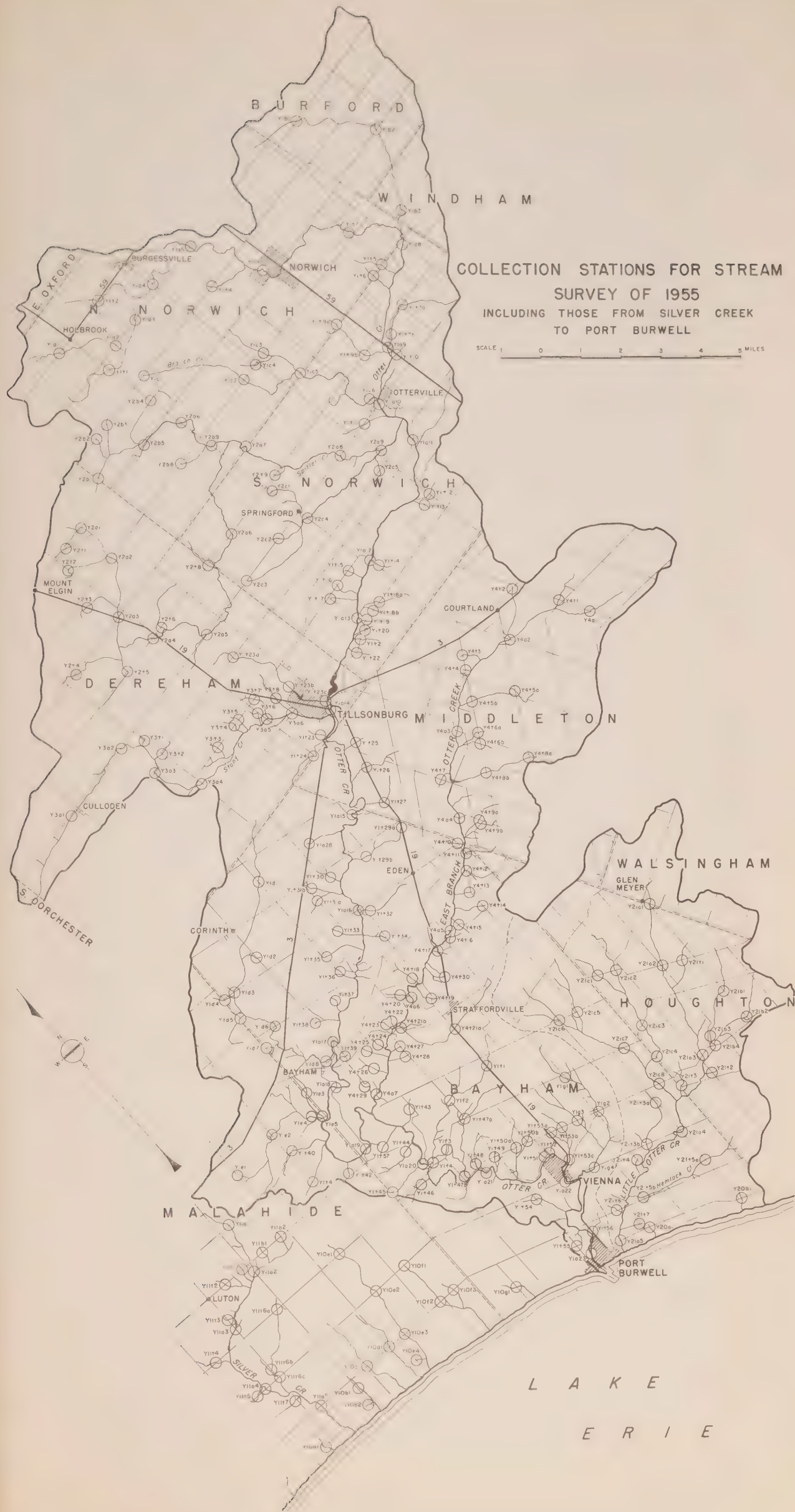
(b) A reconnaissance survey of areas which appeared suitable for spawning of the sea lamprey.

(c) A detailed survey of one area suitable for a demonstration of land and stream improvement for fish and wildlife.

2. Methods

The procedure adopted followed closely that used in previous surveys made by the Department of Planning and Development in other river systems. The rivers and their tributaries were visited at 239 stations from half a mile to three miles apart on each stream course. The topographic features of the valley and the erosion, vegetation, volume of flow, turbidity, temperature and type of bottom were listed for each station. At all suitable stations collections of the aquatic insects and other invertebrates were made. At most of the stations collections of fish were also made. The collections were later examined and classified and were used in zoning the various sections of the river, as shown on the accompanying maps.

The mayflies, stoneflies and caddisflies were most useful for this purpose since some of them are reliable indicators of the stream conditions at the critical time of year. Some species are confined to waters which remain cold and usually clear in summer, such as trout waters. Others are indicators of permanent flow or of polluted waters, or of the maximum summer temperatures of the water. Thus the



potentialities of a stream for particular species of fish are indicated. The fish collections substantiated these findings at many stations. Eight maximum-minimum thermometers and one continuous recording thermometer were installed at various points in the stream courses in the early part of July and in some cases were kept in place until September. Readings from the maximum-minimum thermometers were taken at intervals of two or three days.

Many of the present criteria and methods were originally developed by Dr. F. P. Ide of the Department of Zoology, University of Toronto, on parts of the Nottawasaga River and Algonquin Park streams, already reported on*, and on other streams of Southern Ontario. The analysis by J. C. Hallam† of previous river surveys made by the Department of Planning and Development was also found useful.

3. The River Valley

The variety of kinds and numbers of fish in a river system depends greatly on the physiographic conditions of the watershed. The major features determining the river's condition are therefore mentioned here. The main stream of Otter Creek runs almost continuously in a sand plain from the most northerly point in the watershed down to Tillsonburg. Below Tillsonburg the river runs in a deep and spectacular valley passing through till moraines and clay plains until,

* Ide, F. P. The Effect of Temperature on the Distribution of the Mayfly Fauna of the Stream. University of Toronto Studies, Biology 39, Ontario Fisheries Research Laboratory, Publication 50, 1935.

Ide, F. P. Quantitative Determination of the Insect Fauna of Rapid Water. University of Toronto Studies, Biology 47, Ontario Fisheries Research Laboratory, Publication 59, 1940.

Sprules, W. M. An Ecological Investigation of Stream Insects in Algonquin Park, Ontario. University of Toronto Studies, Biology 56, Ontario Fisheries Research Laboratory, Publication 69, 1947.

† Hallam, J. C. Habitat and Associated Fauna of Selected Species of Fish in Ontario Streams. M.A. Thesis, University of Toronto, 1954.

at a point near Bayham, the river re-enters the sand plains and continues in a narrow and deep valley to Vienna and Port Burwell.

All of the south branch, except a small section near its confluence with the main river, lies in sand plains. The part of the stream course in Elgin County runs also in a
There are no major dams or obstructions

E R R A T A

Wildlife Section

Page 9 - Line 8:-

for Otterville read Rock's dam four miles
north-east of Tillsonburg

Lines 4 and 18:-

for south branch read east branch

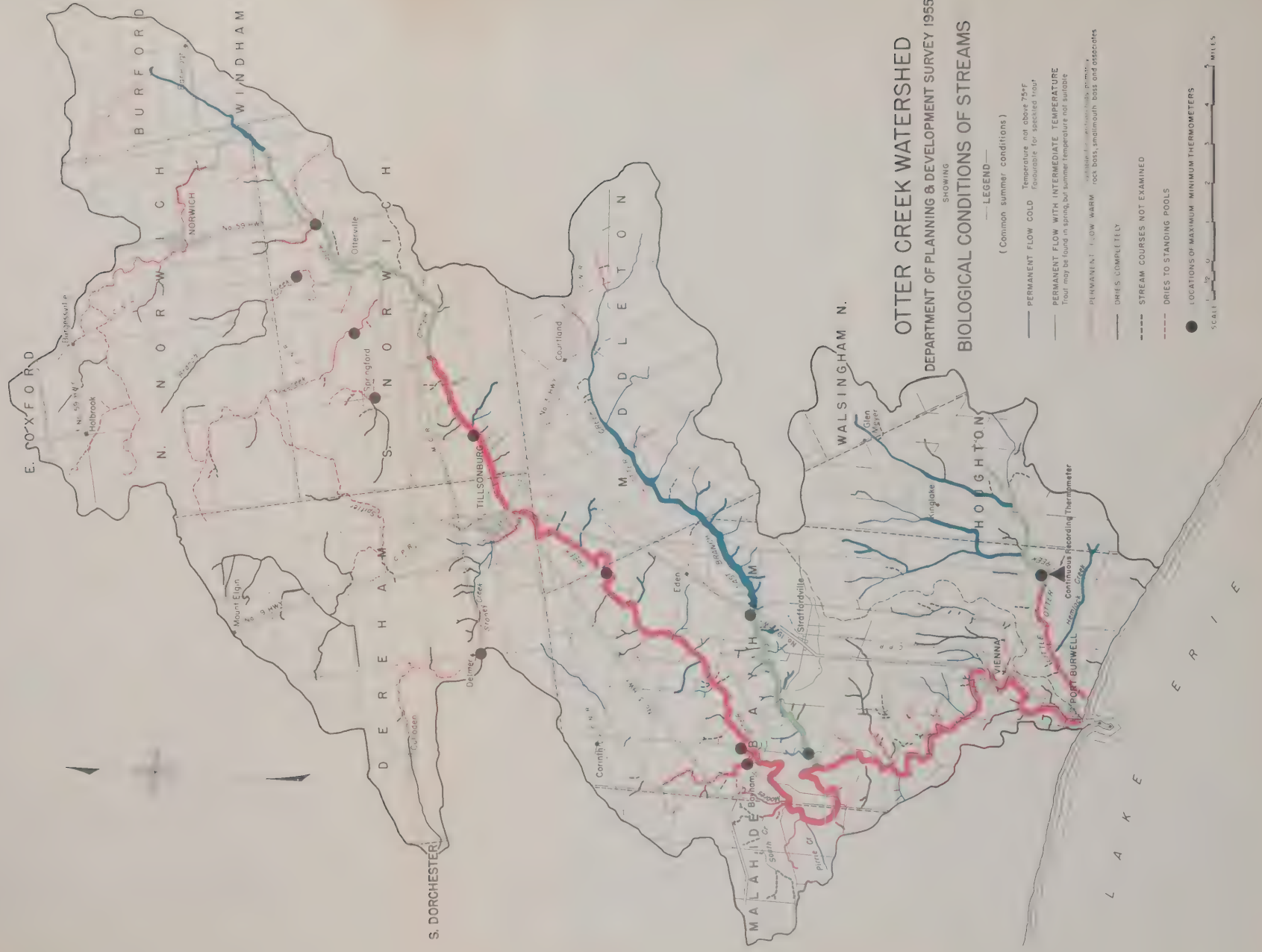
Page 14 - Line 30:-

for Otterville read Rock's dam four miles
north-east of Tillsonburg

the condition of the streams. Thus the south branch, which passes almost entirely through sandy land lying on an impermeable clay, has, considering its area, a very strong flow with numerous small co-tributaries. By comparison, many of the tributaries of the main Otter Creek which drain the till moraine and till plain dry to standing pools or dry up completely. Of the 239 stream course stations examined in the watershed 100 had no flow.

Any description of the stream characteristics must take into account the exceptional weather conditions in the summer of 1955. Most notable were the protracted hot spells and the fact that there was almost no rainfall in July.

A second factor which much affected the stream flow for the first time in 1955 was the extent of irrigation. Stoney Creek, for example, which in its lower sections appeared to be excellent trout water, was pumped dry several times during the summer.

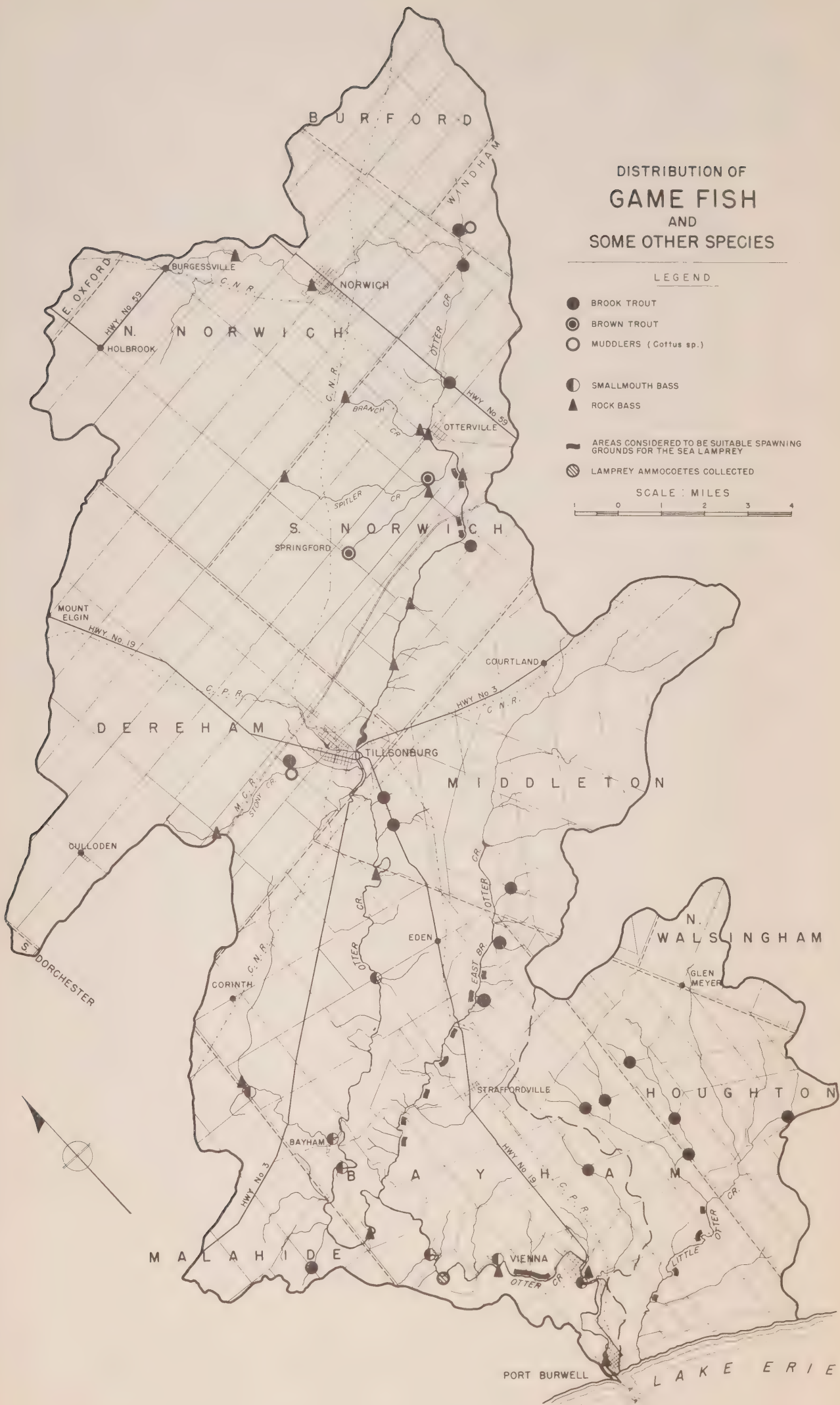


With these two reservations the map "Biological Conditions of Streams" appears to give a fair indication of the temperature conditions affecting the distribution of fish. Adult speckled trout should thrive best in the lower parts of the sections coloured blue. The greatest daily fluctuations in temperature are found in the sections coloured green. Speckled trout may inhabit some of the green sections, particularly the upper parts, in early or late summer, but in an average summer they will move out or be killed in the warm days of mid summer. Brown trout usually adapt themselves better to the higher temperatures in these sections. The sections shown in green commonly have a maximum temperature in summer of 75-80°F. Many of them arise in areas with no cover, such as small marshes or else they have ponds for irrigation on them, which of course warm up the water.

5. Fish Distribution

LIST OF FISHES OF THE OTTER CREEK WATERSHED

<u>Common Name</u>	<u>Scientific Name</u>	<u>No. of Stations at which the Species was collected in the 1955 Survey</u>
*Longnose gar	<u>Lepisosteus osteus</u>	1
*Brown trout	<u>Salmo trutta</u>	2
*Brook trout	<u>Salvelinus fontinalis</u>	18
*White sucker	<u>Catostomus commersonii</u>	54
Hog sucker	<u>Hypentelium nigricans</u>	14
*Northern redhorse	<u>Moxostoma sp.</u>	9
*Carp	<u>Cyprinus carpio</u>	6
Pearl dace	<u>Margariscus margarita</u>	7
*Creek chub	<u>Semotilus atromaculatus</u>	76
Redbelly dace	<u>Chrosomus eos</u>	22
Golden shiner	<u>Notemigonus crysoleucas</u>	2
Fathead minnow	<u>Pimephales promelas</u>	35
*Common shiner	<u>Notropis cornutus</u>	48



<u>Common Name</u>	<u>Scientific Name</u>	<u>No. of Stations at which the Species was collected in the 1955 Survey</u>
Brassy minnow	<u>Hybognathus hankinsoni</u>	11
Hornyhead chub or the River chub	<u>Nocomis sp.</u>	17
Spotfin shiner	<u>Notropis spilopterus</u>	3
Longnose dace	<u>Rhinichthys atratulus</u>	52
Rosyface shiner	<u>Notropis rubellus</u>	8
*Yellow bullhead	<u>Ameiurus natalis</u>	1
*Brown bullhead	<u>Ameiurus nebulosus</u>	2
*Channel catfish	<u>Ictalurus punctatus</u>	1
Stone cat	<u>Noturus flavus</u>	4
Central mudminnow	<u>Umbra limi</u>	8
*Northern pike	<u>Esox lucius</u>	2
*White bass	<u>Lepibema chrysops</u>	1
*Yellow perch	<u>Perca flavescens</u>	2
Logperch	<u>Percina caprodes</u>	1
Sand darter	<u>Ammocrypta pellucida</u>	2
Johnny darter	<u>Boleosoma nigrum</u>	65
Least darter	<u>Microperca microperca</u>	5
*Smallmouth bass	<u>Micropterus dolomieu</u>	7
*Rock bass	<u>Ambloplites rupestris</u>	18
*Pumpkinseed	<u>Lepomis gibbosus</u>	2
*White crappie	<u>Pomoxis annularis</u>	1
Brook silversides	<u>Labidesthes sicculus</u>	1
Mottled sculpin	<u>Cottus bairdii</u>	2
Brook stickleback	<u>Eucalia inconstans</u>	60

(* Species which may be familiar to the angler are starred.)

The naming or terminology in the above list follows that of Scott's "Freshwater Fishes of Eastern Canada". †

† Scott, W. B. Freshwater Fishes of Eastern Canada. University of Toronto Press, 1955 edition.

The Gar pike was found only in the mouth of the river. Brook trout were almost entirely confined to streams rising in the sand plains east of the main Otter, particularly in the east branch and in the Little Otter Creek. Trout also occur north of Otterville. The muddler, a species generally considered as an indicator of trout water, was surprisingly absent from the eastern sandy tributaries. Small-mouth bass are distributed in the main stream from the mouth to a point near Eden. Rock bass were well distributed but apparently absent in the cool east branch and in Little Otter Creek and its tributaries. Northern pike were caught in only two places, but as these fish are more agile than most species they often evade catcher. The various species of catfish were taken from the main stream only. The single specimen of the channel catfish was from a reach near Vienna.

The commonest of the larger fish in the river, both in numbers and distribution, appeared to be the white sucker and the creek chub. Most of the remaining species in the list are small minnows and other species of little interest to the angler.

More intensive collecting would certainly have added several species to the list of fishes. This is particularly true of the area near the mouth of the river. For example the alewife, smelt, and the sea lamprey would probably all be taken at the appropriate season. It was also notable that no largemouth bass were collected, although these occur in the adjoining waters of Big Creek.

6. Sea Lampreys

A general survey of the permanent waters of the Otter Creek drainage basin as well as the waters of Silver Creek and the small streams running into Lake Erie west of Port Burwell, was made during the last two weeks of June 1955, by walking the streams or by canoe, in a search for lampreys, lamprey nests, suitable streams for lamprey spawning and areas

suitable for ammocoetes. The larger creeks were canoed to determine where the rapids furthest down occurred in case any lamprey barrier was contemplated.

Some of the smaller tributaries of the big streams might be ruled out because, being spring-fed, their temperatures would be too low for suitable environment for the lamprey. The Department of Planning and Development could supply additional information concerning streamflow which might rule out some of the small streams which flow into Lake Erie. The areas considered to be suitable spawning grounds for the sea lamprey are shown on the accompanying map "Distribution of Game Fish and Some Other Species". This map also shows the location of one station at which lamprey ammocoetes were collected. The locations of stations referred to in the following report are given in the accompanying map "Collection Stations for Stream Survey of 1955".

(a) Silver Creek

There is a report that a Mr. White, who taught in a public school near Luton 1954-55, saw lampreys presumably spawning in Silver Creek in the spring of 1955. This man was not interviewed.

The stream was surveyed on June 22, 1955. No evidence of lamprey spawning was found.

The dam at Ylla2 was considered a "doubtful" obstacle to lampreys.

The part of the stream between the pond at Ylla3 and station Ylla2 has a bottom of sand in the upstream portion and silt and black muck downstream. Between stations Ylla2 and Ylla3 the stream has some gravel riffles apparently suitable for spawning. Similarly the stream from Yllt6c to Ylla5 has some patches of gravel possibly suitable for spawning.

The small Yl0 creeks examined were considered unsuitable for nests.

(b) The "Main" Otter Creek

No evidence of spawning found.

Parts of the stream above Tillsonburg were surveyed near bridges as shown, on June 24, 1955.

The stream at Norwich had no riffles but did have a gravel bottom. At station Ylall the spawning facilities were considered excellent. At station Yla12 patches of gravel were considered to offer good nesting facilities.

The main creek was canoed from Tillsonburg to Bayham on June 24 and from Bayham to Port Burwell on June 23. The water was quite turbid and fairly deep (4'+) making visual examination of the stream bottom difficult at times.

It is estimated that less than 10 per cent of the stream bottom from Tillsonburg to Bayham is gravel. There were, in the opinion of the field staff, no suitable riffles.

Near Bayham there are a few gravelly rapids, though these were quite heavily silted. The backwaters were mostly of fine sand. The stream bottom is largely sandy, the stream slow moving. The proportion of gravel on the bottom increases progressively to a point approximately 1 mile upstream from Vienna, beyond which no rapids occur. The stream bottom near Port Burwell is largely silted and is slow-moving and turbid.

In the regular stream survey a 4" ammocoete (presumed to be *Petromyzon marinus*) was taken in the 6' seine near station Yla20 on about July 25.

The residents of Vienna interviewed had never heard of lamprey spawning in Otter Creek.

There are no dams on the Otter Creek below Otterville.

(c) The East Branch of Otter Creek

This stream was surveyed June 29, 1955. No evidence of lamprey spawning was found.



Lake Lisgar, in Tillsonburg, a good warm-water pond which, with proper control of all domestic or industrial effluents, should produce a fair annual crop of fish.

A trout stream in a valley with eroded slopes (part of Little Otter Creek). The erosion of these slopes has resulted in much silting of the stream, as is shown in the photograph below. These slopes should eventually be replanted with trees.



The same trout stream which is shown in the centre photograph, here showing the silting which has affected the stream and its banks.

The stream is predominantly sandy bottomed and flows for the most part through wooded pasture. Gravelly riffles occurred occasionally and some of these were considered "possibly suitable" for nesting sites. There are no dams on this stream.

(d) Little Otter Creek

This stream was surveyed June 23, 1955. No clear evidence of spawning was found. There are no dams on this creek.

The stream flows mostly through wet bottomlands with the banks overgrown with vegetation. The stream is fairly slow-flowing with the bottom largely sand and sandy silt. Very small patches of gravel (5' long) occur very infrequently (about one per half mile) and seem improbable for spawning sites. However, a few of these riffles did have scooped out depressions somewhat similar to lamprey nests. When these were stirred up, no evidence of spawn was noted. It was assumed that these were not lamprey nests.

7. Stream Improvements

It has now been agreed that the greatest improvements in fishing will come chiefly from improvement of the habitat or living quarters of the fish. There are three ways in which conditions can be altered. The first is improvement of the land draining into the stream, which may help to control floods and to prevent silting. The second is improvement of the stream bed and its banks with structures or logs placed in the stream or by planting trees and shrubs on the banks. The third is a direct increase in the flow of the stream during the period of critical flow between the end of June and the beginning of November. The flow may be increased if deep wells are drilled and extra water is released into the stream. This may happen in built-up areas or where industrial plants are built near small streams. However, it is much more common to find the waters of a stream being

A trout stream (part of Little Otter Creek) which here is affected by pollution and silting from its use by cattle. This is near Glen Meyer, in Houghton Township.



A very shallow section of a trout stream which could be deepened with ease to give more fish cover.

An excellent stretch of trout water deep and with plenty of cover, which needs no improvement. A by-pass pond is the best way in which the amount of trout water can be increased.



gradually withdrawn for special uses. A great deal of the water of the tributaries of Otter Creek is now removed by tobacco growers for irrigation purposes. A very great number of farm ponds have also been dug in the Otter Creek drainage basin. It is entirely possible that this may lower the water table and eventually reduce the flow of some tributaries.

As an example for possible stream improvements which landowners might carry out, one of the most suitable streams was selected in 1956 and intensively mapped. This was the tributary of Little Otter Creek, which rises close to the village of Glen Meyer. This is a permanent, cool stream with temperatures satisfactory for speckled trout. This map is available for reference.

GOVT PUBNS

~~WB~~ Ontario. Dept. of Planning and
~~117~~ Development
~~064516~~ Otter Valley conservation
~~1757~~ report
~~cop.2~~

Geography

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DECATALOGUED

**OTTER CREEK
WATERSHED**
SHOWING
AREAS RECOMMENDED
FOR AUTHORITY FOREST
AND
EXISTING WOODLAND



ONTARIO DEPARTMENT OF PLANNING AND DEVELOPMENT
CONSERVATION BRANCH

FOREST COVER TYPES

- 4 ASPEN
- 45 POPLAR - OAK
- 5 PIN CHERRY
- 6 WHITE PINE - RED OAK - WHITE ASH
- 9 WHITE PINE
- 10 WHITE PINE - HEMLOCK
- 11 HEMLOCK
- 12 SUGAR MAPLE - BEECH - YELLOW BIRCH
- 13 SUGAR MAPLE - BASSWOOD
- 14 SUGAR MAPLE
- 142 BLACK CHERRY
- 24 WHITE CEDAR
- 25 TAMARACK
- 26 BLACK ASH - WHITE ELM - RED MAPLE
- 45 BUR OAK
- 47 BLACK LOCUST
- 49 WHITE OAK - BLACK OAK - RED OAK
- 496 WHITE OAK - BLACK OAK - HICKORY
- 50 WHITE OAK
- 51 RED OAK - BASSWOOD - WHITE ASH
- 57 BEECH - SUGAR MAPLE
- 58 BEECH
- 59 ASH - HICKORY
- 60 SILVER MAPLE - WHITE ELM
- 606 WHITE ELM
- 61 COTTONWOOD
- 88 WILLOW



OTTER CREEK WATERSHED SHOWING AREAS RECOMMENDED FOR AUTHORITY FOREST AND EXISTING WOODLAND

